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In regards to objects designed for children, trends of the moment continue to highly influence the market. These design trends, however, do not often reflect a true understanding of the child as a user. Research shows that versatility, multi-use and ability to function for the growing child are fundamental in designing products for preschool-age children. To achieve these attributes, designers should turn away from designs that are too specific and instead provide varied, abstract forms that would give children more autonomy in their creative play.

This thesis develops and evaluates a play system design for preschool-age children using the concept of interaction as its foundation. Areas of supporting literature include interactive design theory and practice, play, child development, and qualitative research methods as it relates to study with children. The play system, created through a generative design process, is validated through case-study observations and professional assessments. Results, from this thesis investigation, reveal that the play system design succeeds in promoting different areas of child development. Findings from the analysis also illustrate the potential benefits of interaction between a product and its user.

UNSCRIPTED ACTIONS: DESIGNING FOR PRODUCT INTERACTION THROUGH A PRESCHOOL PLAY SYSTEM

by

Tiffany Ann Stewart

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Approved by

_____
Committee Chair

To my family,

Paul, Barbara and Trenton Stewart,

for your everlasting encouragement, love, and support.

If you'll help me to
ask my own questions
try out my ideas
experience what is around me
share what I find

If I have
plenty of time for
my special pace
a nourishing space
things to transform

If you'll be
my patient friend
trusted guide
fellow investigator
partner in learning

Then I will
explore the world
discover my voice
and tell you
what I know in

The Hundred Languages of Children

From The Hundred Languages of Children Exhibit, Reggio Emilia

APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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Date of Final Oral Examination

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CHAPTER I

INTRODUCTION

This thesis investigation of interior products focuses on the concept of product interaction as it relates to the design of objects for preschool children. Through interactive design, designers entice their clients to take on a more active role in shaping their own environments. By allowing users to manipulate a post-production product to their liking, the design of the object does not simply end with the designer but instead lives on in the hands of those who will give it its true meaning and value. When asked about their work, current designers Erwan and Ronan Bouroullec state, "our designs are suggestions, not statements. We like to keep our distance and our sense of humor so that our solutions don't end up becoming hard-and-fast rules" (Conran & Fraser, 2004, p. 64).

Based on these ideas, this research seeks to establish a dialogue between designer, user, and object even after the product production stage is complete. The investigation explores whether or not interactive design can stimulate a child's creativity by allowing the child to participate in defining the overall design outcomes. The goal is to design a structure that is a product OF the child versus one that is a ready-made design FOR the child. The overall intent is to free a child's imagination through abstraction. A more defined objective is to design ambiguous and versatile forms that encourage experimentation devoid of excessive instruction, giving children the chance to freely invent, define, and redefine.

History shows that objects designed for children are often simply derived from miniature forms of adult-sized products. The criteria needed in designing for children reaches far beyond simply size and dimension adjustments. While smaller sized furniture may appear cute, children do not perform everyday tasks in the same manner as adults and therefore designers should push boundaries and speak to alternative typologies when designing for children. As with any other design process, design for young children should address certain considerations appropriate for the specific client. While children may not always be competent in directly communicating their needs verbally, they are certainly capable of manipulation and exploration with objects. Therefore, by merging interactive design with children's products, children are encouraged to become more involved in the development of their own surroundings.

The research directing this thesis stems from several disciplines. The study begins with a review of literature pertaining to interactive design theory and practice along with techniques for stimulating product interaction. From this base emerge three additional research avenues relating directly to the intended product user. The field of Child Development is explored to gain a better understanding of social, cognitive, gross motor, and creative development among preschool-age children. Research regarding the topic of Play reveals the daily activities of children and provides this study with a suitable context for the designed product. Finally, literature on qualitative research techniques is reviewed in hopes of establishing an appropriate method for evaluating and testing the designed play system.

Knowledge from this review of literature informs the methodologies used for design investigation, initial testing, evaluation and analysis. The researcher/designer brings together these disciplines of research and process in an attempt to answer the main question of this thesis: Can a designer influence child development through the creation of interactive products? With this question in mind, the thesis investigation encompasses the work of design, testing, and professional evaluation in an effort to materialize a sound case-study base that will ideally provide a foundation for further related research.

CHAPTER II

REVIEW OF LITERATURE

In the discipline of product design, designers work hard in an attempt to predict the values and desires of their clients. At the conclusion of much development and refinement, products delve into the marketplace with high hopes of integration and acceptance. In most cases, these products come with an established function and preconceived meaning, eliminating the user from the creative process.

The concept of interactive design stands against the static quality of products and instead promotes full exploration and manipulation by its user. With this in mind, interactive design can benefit clients of all ages and works naturally along side of developing children. Children's intrigue with visual changes to the environment supports the theory that a substantial portion of their learning takes place through visual and tactile experience. If children are allowed to participate in a creative endeavor and their ideas are valued, they may extend their engagement with that activity. If there is an attempt to learn from experts and the actions of children themselves, products and environments designed and developed for this specialized group may become more appropriate and influential. The following review of literature brings together the topics of interactive design, play and development as it relates to children, and practices appropriate for

research concerning children, in hopes of establishing an intellectual base for this product development study.

Interactive Design Theory and Practice

Italian semiotician Umberto Eco states that the architect is continually obliged to be something other than an architect. The designer may wear the hat of sociologist, psychologist, or anthropologist at any given stage of the design process (Eco, 1997). With this in mind, the architect is constantly forced to "think in terms of totality" (Eco, 1997, p.199). By approaching design from a multidisciplinary avenue, the product solution can more easily provide what Umberto Eco terms as "variable primary functions and open secondary functions" (Eco, 1997, p.200).

The idea behind interactive design speaks strongly to the notion of primary and secondary functions. The design process itself demands collaboration and remains open to interpretation and refinement. Through this approach, resulting design solutions may take on various forms, invoke personal meanings and create a quality of experience that is unique to each participant.

Defining Interaction in Design

Interaction-centered models of the design process explore the role that products serve in bridging the gap between designer and user (Forlizzi & Battarbee, 2004). According to John Dewey, an American philosopher, the term "interaction" is used to describe the relationship between the individual and the environment (Margolin, 1997). This defined relationship then in turn dictates the type of experience that will occur.

Quality of experience quickly becomes the center of the design model, as designers strive to understand the complexities involved in human experience and the methods in designing, scripting and facilitating them (Forlizzi & Ford, 2000).

Interactive design thrives off of the interplay between object and user in which the user exploits the vitality of his environment and draws upon his imagination to create his world (Friedberg, 1970). The user determines the degree of this interplay at each encounter. The interaction may occur physically or emotionally depending on how the participant chooses to relate to a product or environment. Choice, therefore, becomes an important way of controlling one's experience and a key element to interactive design. The focus is to provide as many different ways of relating to the design as possible (Dattner, 1969). Environments, therefore, that are void of choice, complexity and interaction will be empty of users (Friedberg, 1970). Interaction gives the user control. To achieve this control, designers must create designs that respond directly to the user.

Through interactive design, a user gains the opportunity to express himself and have an effect on his environment. The designer in this case constructs only the bare bones of the experience, while the rest of the packaging is left open to interpretation. In this sense, the product design process can be logically linked to interpretative and fine arts. In these fields, "the performance at different times and on different occasions is, and must be, different" (Gadamer, 1997, p.128). In essence, differing performances act as a driving force for interaction between product and user where no one knows beforehand what will thrive and what will have no resonance. The score is really only a direction and "the work itself is what 'takes place' in the performative event" (Gadamer, 1997, p.128).

In this scenario, the nature and intensity of the direction that the score provides becomes a crucial element to the design process. The ideal persists in seeking a balance between freedom and dictation. “To some degree this is an issue of minimum and maximum: too few lines prevent the suggestion of a solution, too many restrict further development (Leatherbarrow, 1998, p.55).

Ultimately, the designer seeks to encourage their clients to become involved in the design of their environments. The challenge lies in promoting experimentation with construction and destruction without subjecting the user to excessive direction or discipline (Friedberg, 1970). Overall, design solutions that are interactive possess qualities of flexibility and adaptability. Due to these qualities, the product can enter into a dialog with both its designer and its user being defined and redefined from multiple perspectives.

Interaction Gives Meaning

Designer Matali Crasset uses interaction in the design process itself by creating stories that design problems and then objects that prove to be their solutions (Williams, 2006). Through this method, Crasset takes on design as a fully, hands-on event. She pulls in her experiences and the stories of those around her in order to achieve a high level of intimacy and personalization for a project. By erasing the presence of static design and pushing further for a more give and take approach, designers can strive for the optimization of both function and meaning (Williams, 2007). Looking from the designer’s view of a creative process, Crasset gives meaning to her designs through her design approach while leaving a path open for her clients to do the same.

According to scholar Ann Smart Martin, the interaction of people, ideas, and material objects acts as a key theme that ties together consumerism, consumption, and materialism (Martin, 1993). This idea of interaction illustrates the ways in which people can construct their own meanings for objects produced by themselves or others (Martin, 1993). An object can certainly exist on its own, but a deeper level of value and meaning ultimately comes from the product's exchange with the creator and user. If a user takes the initiative to participate in the design process, the product and overall experience will become more personal. As the experience becomes more personal, the user will claim ownership and the value of a product extends beyond simple function.

In a project titled "DO CREATE" conducted by Kesselskramer and Droog Design, researchers explored the idea of enhancing and prolonging our relationship with our consumer products by observing what people might do to things to make them their own. The projects in this study were always left unfinished and could only exist through the interaction of the user (Williams, 2006). The design ideas bordered on extreme considering that they asked their users to sculpt metal chairs with hammers and etch personalized messages with screwdrivers. None-the-less, the overall concept was powerful. Products gain more meaning if the user is given an opportunity to contribute to an open-ended solution.

Another design team, Shin and Tomoko Azumi, state that "above all, their work focuses on the manner of using objects and suggests new ways of interacting with them…objects should always give us pleasure-not just when we look at them but when we use them" (Design Museum). This quote presents another strong idea. Whether or not

the reaction is pleasure, if the relationship between a product and its user evokes an emotional response, the overall connection strengthens and the product's value is enhanced.

Interaction through Modularity and Flexibility

In order for users to participate in the design process, designers have looked to facilitate interaction with their products through modular and flexible solutions. "The module is only a basic building block with which the designer can create an unlimited variety of designs. Far from limiting him, the module frees him. The designer is potentially the designer of a total environment that works in various ways and can be unlike any that has been created before" (Friedberg, 1970, p.46).

The desire for furniture to be flexible and multifunctional has been around since the ancient designs of the Greeks and Romans where men in power both ate and reclined on the same furniture form. The concrete idea of modules, however, has only been utilized since the middle of the twentieth century. Influential designers such as Charles and Ray Eames along with Joe Colombo carved the path of flexible design in their mid-century modern aesthetics to be followed by current designers such as Ronan and Erwan Bouroullec.

The workshop of Charles and Ray Eames cherished a hands-on approach to learning by doing, and a belief that children and adults could do many more tasks than they or society deemed them capable of, if only given an encouraging environment and sufficient stimulation (Kirkham, 1995). This couple had a serious approach to fun activities and aimed to make creative development pleasurable. Their toy designs

encouraged the expansion of the child's mental and imaginative powers and acted as vehicles for creative play. The playful and fun personalities of both Charles and Ray Eames led to their sheer and utter joy in objects emphasizing detail, color, texture and craft. Their toys, including House of Cards and Little Toy, required active participation and it was the child who decided the final shape and form (Kirkham, 1995).

Two key considerations in the Eameses' designs were versatility and flexibility. They looked at not simply making furniture but instead making a way of life, changing the ideas of typology. Adaptability in their designs was possible because much of the Eameses' furniture was made of standardized parts that could be combined into different arrangements, offering customers the flexibility to mix and match different pieces to suit their needs (Albrecht, 1997). The Eames Storage Unit, designed in 1950, functions through a modular steel frame and emphasizes standardization with a variety to be achieved through interchangeability of components (Kirkham, 1995).

Charles and Ray Eames not only used the flexibility concept in products, but they also extended this knowledge into their architectural designs. The Kwikset House, one of their famous case study projects, resulted in an interactive product that encouraged owners to engage directly in the process of its construction and to customize the design for their own needs (Kirkham, 1995). This idea served as a fundamental premise. In their own house, Charles and Ray Eames blurred the distinction between designer and occupant. They saw the role of the designer as that of a very good and thoughtful host, all of whose energy goes into trying to anticipate the needs of his guests. Rather than offer a

complete environment to the postwar consumer, the Eameses presented a variety of components that individuals could construct and rearrange themselves (Albrecht, 1997).

According to Joe Colombo, "if elements and equipment necessary to human existence could be planned with the requirements of maneuverability, flexibility, and the ability to be broken down almost totally to their component parts, then we would create an inhabitable system that could be adapted to any situation in space and time…" (Favatta & Fagone, 1988). With this in mind, an analysis of the objects designed by Colombo has to take into account the three progressive stages of this experimentation: the single object, the object as part of an expandable system, and the possibility of combining different functions with multifunctional mobile units (Favatta et al., 1988). Colombo rejects closed and motionless space in favor of modularity and looks for his products to be autonomous, flexible, convertible, and adaptable. Elements as part of an expandable system can either have well-defined shapes and be used independently or possess the need to be combined in order to give rise to any usable form (Favatta et al., 1988).

The Tube Chair was designed by Colombo in 1969. It is made of a semi-rigid plastic covered in plastic foam and colored fabric. The tubes are different sizes and therefore can create a variety of seat heights and lengths through the connection of special joints made of rubber and metal. The Additional System created in 1967 contains cushion like elements molded out of polyurethane with a metal stiffening structure covered in elasticized cloth. Other similar furniture products include Multi-Chair, Combi-Center, and Triangular Container System.

The Bouroullec brothers are current day, twenty first century designers who bring to the table a sense of play in modular design similar to that of Charles and Ray Eames. They ask their users to configure their own space and shape their own furnishings all while bringing joy and pleasure to the experience. According to Ronan and Erwan Bouroullec, "ease of assembly…along with modularity opens up an area of autonomy for the user…simplicity of construction forces you to go back to simple gestures, to common sense, to a universal skill" (Bouroullec & Bouroullec, 2003, p.160). They also believe that irregularity of the modular components will lead to individuality of form, due to the increased possibilities of connections.

The Combinatory Vases designed by the Bouroullec brothers combine separate elements to create a vase. The pieces have no function in isolation. The designers stress the idea that this concept hands the job over to the user and creates diversity in a product series line. The Joyn Office System presents a palette of components that are to be reconfigured by the people who will later use it. In the words of Ronan and Erwan Bouroullec on the subject of Joyn, "simplicity and humor are prerequisites for the emergence of a natural whole. So that every little change that a user wants to make…every idea that he wants to realize is completely natural" (Bouroullec et al., 2003, p.44). With this furniture system, these current designers seek overall to create an open system that gives people an opportunity to adapt a room to their preferences.

Child's Play

When focused on the world of children, the term interaction naturally links to play. In connection with interactive design, children's play involves manipulation and exploration of their environment and the objects within. Children develop an awareness of object properties, both functional and meaningful, as well as gain the ability to consider relationships between themselves and their surroundings. Through this awareness, they begin to control and regulate their play environment rather than behaving as captives of the play setting (Fenson, 1985). Play gives children a means through which they can determine the ultimate value and function of the things that surround them in their everyday world.

Definition of Play

During the preschool years, play continues to evolve in regards to its maturity level. During this time, children create extensive imaginary play situations that incorporate complex roles and settings (Bodrova & Leong, 2006). For them, work and play act as the same. When children play, they are fully engaged in the activity. For the most part, they are completely committed to the experience and therefore play can be both emotionally and physically exhausting. Children use play to help define their role in everyday routines just as adults use work to define their role.

It has proven to be a challenge among experts and researchers to define the concept of "play" in concrete terms. "Play" functions as both noun and verb. Although the term is referenced in the adult world, its more natural use is in the world of children. The overall idea behind play is generally understood and agreed upon by those who are

involved in its study. It is the specific detailing of a definition, however, that has caused conflicts and differing of opinions. Experts Rubin, Fein, and Vadernberg have developed a list of descriptive characteristics to help define play in specific terms. This collection consists of six items that serve to focus discussions on play. This definitional criterion for play is often extended by experts in various academic fields but these six characteristics function as a basis for research study (Coplan, Rubin & Findlay, 2006).

The first descriptive characteristic of Play is that it has no extrinsic goals. The motivations during play are intrinsic and serve no other objectives (Coplan et al., 2006). Overall, the process of play is more of an enjoyment than any effort given to some particular end. In other words, the act is process-oriented versus product-oriented (Garvey, 1990). Participants of play look to play as an end in itself and a creator of its own value.

The quality of spontaneity characterizes the second criteria in the definition of Play (Coplan et al., 2006). Those engaging in play do not plan out the details beforehand. Actions are completely voluntary. As children are involved in play activities, they produce continuous ideas that may appear either random or logical. Either way, these ideas feed into a spontaneous change or progress of play.

A third feature of Play revolves around the notion that it is different from simple exploration. The term play implies that the participant has some degree of control over the activity (Coplan et al., 2006). Whereas exploration merely questions what an object is or what it can do, play inquires what the participant can do to/with the object. Play demands that a child has a say in the functional or emotional outcome of an activity.

Pleasurable is a fourth characteristic of Play (Coplan et al., 2006). Even when it is not actually accompanied by signs of enjoyment, play is still positively valued by the participant. It serves only as a pretense, not as a serious rendition of the activities or behaviors that it might resemble. As children engage in play, their non-literal interpretations bring pleasure to their environment.

As a fifth quality, Play is free from externally imposed rules (Coplan et al., 2006). This notion separates play from games-with-rules. Once emerged in the act of play, children can direct or script their activities according to guidelines formulated based on ideas within the play. The play participants, however, create these guidelines. They are not enforced by outside peers or adults.

Finally, Play involves active engagement (Coplan et al., 2006). This characteristic helps to distinguish play from daydreaming or lounging. In play, the player is fully involved in the activity, requiring both mental and physical participation. This engagement may be in respect to other people, objects, or the environment as a whole.

Types of Play

Literature shows that the definition of play stems beyond a simple list of descriptive characteristics. Experts look further to divide play into types, kinds and categories. Through this method, different levels of play can be associated with factors such as age, object type, environmental settings, and social interaction.

Play theorist, Jean Piaget, divides play into three types: sensorimotor, symbolic, and games with rules (Garvey, 1990). These divisions are strongly linked to the age and major changes in growth of play participants. Sensorimotor play dominates children

between infancy and two years old. The overall play consists of repeating and varying motion. In this type of play, children acquire control over movements and learn to coordinate gestures and perceptions (Garvey, 1990). The second type of play, according to Piaget, is symbolic or representational (Garvey, 1990). This type of play is most often experienced by children between the ages of two and six. In representational play, experiences are encoded in symbols. In other words, objects, people, and environments can now be brought into a pretend world where their meaning and function depends on the player. The third type of play is labeled as games with rules (Garvey, 1990). This category is predominated by older children and adults. In games with rules, participants understand social concepts of cooperation and competition.

Borrowing on Piaget's ideas list above, Sara Smilansky divides play into four categories. These categories are again separated by age and developmental level. According to Smilansky, the first category of play is functional play. Similar to Piaget's sensorimotor label, functional play is found in infancy and involves the repetition of same movements (Rubin, 1985). Smilansky then follows with two play categories that coincide during the preschool years. Constructive play arises as players use materials to construct or create something. The resulting build remains present even after the child is done playing. Dramatic play involves symbolic transformations. This category of play produces decontextualized behaviors in pretend play (Rubin, 1985). Smilansky titles her last category of play the same as Piaget's final type. In Smilansky's mind, games with rules also accounts for play in older children and adults. Participants in this category of play accept division of labor and prearranged rules.

In regards to social interaction during play, psychologist Mildred Parten defines four categories pertaining to semi-social and social activity. Solitary play occurs most likely in two year olds and is defined as play that is apart from other children (Coplan et al., 2006). Under these circumstances, little or no attention is paid to other children or adults. The label Parallel play is given to play in which a child plays beside but not with other children (Coplan et al., 2006). In this case, the children at play are within close proximity to each other but have no direct interaction. The third level of play, according to Parten, is Associative play. In this category of play, a child interacts with other children and may use similar materials to other children, but there is still no real indication of cooperation (Coplan et al., 2006). Parten suggests that the last type of play with the highest level of social interaction is Cooperative play. In cooperative play, the activity includes a group that is organized for the purpose of carrying out a specific action or attaining a common goal (Coplan et al., 2006).

In the analysis of fantasy play as it relates to individuals, play expert Peter Slade suggests two forms of play: personal and projected (Baker, 1975). Personal play refers to the world that the child creates which is often simply a reflection of the adult world. In this form of play, the players themselves take the place of physical objects and become a thing or person, promoting the concept of learning by doing (Baker, 1975). On the opposite side, Projected play labels the scenario in which a child imagines an object to have a life of its own. These objects should allow for a child's imagination to create various uses and meanings. Under this form of play, the more representational an object is the quicker the player will become bored. Instead, objects should promote trial and

error of the mind and body (Baker, 1975). Slade's concept of projected play, therefore, relates closely to the idea of unstructured materials. Unstructured materials are flexible and adaptable. As a result of these attributes they tend to promote varied uses and functions. Structured play materials, on the other hand, are less open and often times only allow for one, pre-defined use.

Play with Objects

Objects in play serve as a link between the child and the environment. This link occurs in several manners according to scholar Catherine Garvey. Play objects provide children with the means to represent or express feelings, concerns and interests. In addition, they provide a channel for social interaction with both adults and fellow peers. Lastly, an unfamiliar object sets up a chain of exploration, familiarization and eventual understanding (Garvey, 1990). Overall, objects in a play environment should arouse a child's curiosity and desire to learn.

Preschool children between the ages of three and five tend to use objects as symbolic tools. Often these symbols are carried into play as props to develop pretend play and story episodes that involve other children. Extending this play into a social context with playmates indicates that this age period is the first in which children develop skills in sharing the meanings embedded in their object play (Morgenthaler, 2006). Players take complete control over these object meanings. An object may act as one symbol for the entire duration of a play episode or it may change meaning numerous times.

During the preschool years, children's play with blocks in particular also becomes more important. Again, the play participants take responsibility in giving each block structure meaning and function (Mogenthaler, 2006). Block play serves as a prime example of what is more largely termed as construction play. There are generally four types of products that come from constructive play. Two of these four relate to children between the ages of three and five. First off, constructive play can result in patterns. Under this category, the goal of the player is pure symmetry, variations on symmetry, or repeated motifs. Children seeking patterns are intrigued by regularities, repetition, and permutations (Forman, 2006). The second typical product of constructive play from preschoolers is an object. In this case, the product is determined by the child's reflective thinking about something external to the play environment (Forman, 2006). For example, children could use construction materials to create the form of a car or ship that then becomes a reference object for their play.

According to professor of education, Shirley Morgethaler, the function that objects serve in the context of play has been discussed through several theoretical views. Two of these views in particular relate to the role of object play as it relates to the preschool age range. The Pragmatic view, based off the work of Theodore Wachs, focuses on the concept that play in general has a practical function and purpose and objects serve as a means to that designated purpose (Morgenthaler, 2006). According to this view, the nature of children's object play is influenced by the attributes of the objects. An object's response to manipulation acts as an example of one such attribute. In this environment, adult interaction with the children is kept to a minimum due to the

notion that object's themselves provide the stimuli for interaction. The Developmental or Cognitive theoretical view, based on the work of Piaget, includes similar ideas regarding the intensity of adult interaction. This view values the ability of an adult to observe and encourage without excessive intrusion. This allows children to develop internal problem-solving strategies through reasoning (Morgenthaler, 2006). Object play in this category enhances these skills through the manipulation of components with the purpose of reproducing design patterns or creating original designs.

When children first encounter a new object in a play setting, the process of interaction typically follows four main avenues: exploration, manipulation, practice, and repetition (Garvey, 1990). These phases of interaction often occur all in one session of play, but may be extended through further encounters. During exploration, children investigate the qualities of the object both visually and physically. They use their five senses to inspect the object's unique characteristics. After exploration follows manipulation. Through manipulation, the player seeks to determine what the object can do. The child may engage the object from multiple perspectives and search for moveable parts that indicate extended function or purpose. Once the child has discovered what the object is and what it can do, he begins the journey to define what he can do to the object. This process is termed practice. Practice includes activities that try out ideas. As children go through trial and error, they figure out which ideas work best and which ideas can be cast aside. At the tail end of practice comes repetition. During repetition, children synthesize their gathered knowledge about this new object and put it to test. Repetition

exists with or without imaginative elaboration depending on the age and developmental stage of the participant. Either way, this last stage can readily be accepted as play.

Overall, the goals of play are flexible, self-imposed and may change during the course of play. A good play environment is one that invites the participant to come in and change it. For preschool children, the simpler the play material, the more effective they are for stimulating creative play (Almon, 2003). In fact, if children are not satisfied with their play materials, they become inventive and resourceful, making or finding what they deem necessary to complete their play. Piaget postulated that much of children's early learning occurs as a result of direct encounters with the physical environment and therefore the optimal setting for young children is one that includes a wide variety of responsive objects for interactive play (Bradley, 1986).

Child Development

In general, play is the medium for learning that integrates all aspects of human development and helps children develop skills and attitudes they need (Gestwicki, 1999). The act of play provides children with the chance to practice divergent thinking. In other words, children use objects in novel ways and increase their ability to think flexibly and inventively as they solve problems that arise. The physical environment becomes increasing important in enhancing development in young children and supporting interactive learning. As children create imaginary situations for play, they develop abstract thought that in turn increases their cognitive abilities (Gestwicki, 1999).

Physical Development

The preschool years are crucial to acquiring basic fine and gross motor skills. Gross motor development refers to both locomotor dexterity in balance and movement along with upper body and arm skills. The locomotor dexterity can be enhanced through actions such as running, jumping, twirling, climbing and crawling. In the fine motor skills category, children in the age range of three to five are gaining more precision with the use of hands and fingers (Frost, Wortham & Reifel, 2005). In the preschool setting, these skills are being developed through activities such as puzzles, cutting with scissors, grasping markers, building with blocks and modeling in clay.

Beyond fine and gross motor skills, development experts talk about perceptual motor skills. Perceptual motor skills are monitored through a child's developing ability to interact with the environment and ends up combining the use of senses with motor skills. For example, visual, auditory, and tactile sensory abilities are combined with fine and gross motor skills to develop an understanding of body, spatial, directional and temporal awareness in a child (Frost et al., 2005).

Piaget: Intellectual and Spatial Development

In reference to cognitive development, theorist Jean Piaget characterizes preschool children in the age range of two to seven as the preoperational stage of development. The preoperational stage has two sub-stages. The symbolic function sub-stage takes place in children two to four years old and it allows them to picture things mentally that are not physically present. The intuitive thought sub-stage occurs in

children between four and seven years old and refers to the time span when primitive reasoning begins. (Frost et al., 2005).

Piaget interprets intellectual development as occurring by a process of constructivism through interaction with other people, materials, and experiences (Gestwicki, 1999). He believes that as children form and test their own hypotheses about how the world works, their thought processes and mental structures undergo continual revision. In his theory on cognitive development, Piaget argues that children interact with and adapt to their environments using the continual process of assimilation and accommodation (Ness & Farenga, 2007).

Piaget's research also taps into the study of spatial development. At the preschool level, he proposes that spatial development in children is closely connected with five key elements: proximity, separation, order, enclosure, and continuity (Ness et al., 2007). In terms of object play, proximity refers to how close objects are to one another or to outside elements. Separation defines how two or more objects are distinguishable. Order describes how and when two or more objects appear. Enclosure deals with the location of a middle object. Continuity categorizes the sequences of objects (Ness et al., 2007). Children's mental grasp of these five elements determines the degree of development in terms of spatial awareness.

In the topological primacy thesis, Piaget continues his theory of the child's conception of space. Divided into sub-stages, his thesis covers children between birth and seven years of age. In sub-stage IB, children between the ages of three-and-a-half and five years old are able to distinguish between figures that are closed and those that are

open (Ness et al., 2007). For example, a child understands the difference between a square and a u-shape but has a hard time distinguishing between a square and a circle because both are closed. In sub-stage IIA, children between four-and-a-half and five years old now demonstrate crude recognition between rectilinear and curvilinear shapes (Ness et al., 2007). They are able to differentiate shapes by angles and dimensions.

In general, Piaget simply argues that children do not think in the same way as grown-ups. Through his studies with children, the image of a child becomes less like that of a container waiting to be filled with knowledge and more like that of an active builder, in control of the construction of knowledge. As children develop, they constantly alter their cognitive structures. If experiences are repeated, they fit neatly into an already existing structure. However, if an experience is new, the child alters its cognitive structure to accommodate for the construction of this new knowledge. As this new knowledge is constructed, children continue to reinvent themselves.

Vygotsky: Sociocultural and Cognitive Development

The sociocultural learning theory, proposed by theorist Lev Vygotsky, emphasizes the importance of the social interaction and cultural context in cognitive development (Gestwicki, 1999). Working within a Marxist tradition, Vygotsky's work deals largely with the relationship between humans and their environment (Bradly, 1986). His theories argue that development occurs at its highest level when children are in contact with peers and adults in a social setting. Vygotsky also claims that the environment, whether in the physical or social sense, greatly impacts the actions and learning processes of children.

In connecting objects to intellectual development among preschool children, a key to understanding the relevance of Vygotsky is his concept of "zone of proximal development" (Bradley, 1986). In this theory, Vygotsky proposes that there are two developmental levels. The first level is the "actual developmental level." This level includes mental functions that have already been established as a result of certain already completed development cycles (Bradley, 1986). The second category is the "potential developmental level." The potential element includes things a child can accomplish with the help of an adult or older peer but cannot do on his own (Bradley, 1986). With these two level distinctions in mind, the "zone of proximal development" refers to the distance between the actual developmental level and the level of potential development (Bradley, 1986).

Vygotsky believes that toys and other objects can help to enhance learning by creating a zone of proximal development. In order for this to occur, he argues that an object serves as an initiator of action, a catalyst for incidental learning, the focus of social learning, the subject of instruction and demonstration, or a prop for imaginative and pretend play (Bradley, 1986). In essence, objects help to bring forward the interactions needed for children to develop skills in multiple areas of growth.

Objects and Development

While development in young children is not dependent on objects or toys, these additions to the environment prove to enhance the overall experience. Objects form a basis for purposive encounters. These encounters themselves involve learning but they also may lead to further development in both cognitive and social domains. The degree in

which objects can aide in child development depends on the nature of the objects themselves. Materials that can be moved, manipulated, or changed feed strongly into developmental needs of preschool children (Nicolson & Shipstead, 2002). Objects that can draw children into action serve as a source for skill development and tool mastery.

The connection between play materials and intellectual development may act as a joint relationship to social interaction and social development (Bradley, 1986). As a part of social development, children learn from both adults and peers about new skills and generally the workings of the world around them. Objects help to focus social encounters through activities such as imaginative play or concept demonstration. These social experiences provide opportunities for both direct and indirect growth and development. Depending on the object and experience, this growth can relate to language skills, gross motor movement, divergent thinking, or even emotional understanding of another child's feelings.

Objects serve as a catalyst for imaginative play due to its link between the imaginative world and the more concrete setting of the real world (Bradley, 1986). Objects have the ability to act as they are in reality or to gain alternative meaning through its assignment as a symbol. Through this aptitude, objects can function with two or more meanings simultaneously. This gives them greater value and status in a child's world that is full of exploration. In general, play materials enlist three major intrinsic motives: curiosity, mastery, and affiliation (Bradley, 1986). Each of these motives enhances the probability that positive development of some nature will occur as a result of the interaction between user and product.

Creativity and Development

According to the text of *Play and Child Development,* young children's creativity has three unique characteristics. First, creative children can be sensitive to internal and external stimuli. Second, children demonstrate a lack of inhibition and therefore become completely absorbed in the creative activity. And finally, children have the unique ability to use imagination and fantasy (Frost et al., 2005). The availability of an enriched and flexible play environment with less intrusive adult intervention facilitates creativity in play (Frost et al., 2005). Unstructured play materials that are both diverse in playability and simple in design can help support this flexible play environment and may work to promote creative activity in preschool aged children.

When looking at the relationship between creativity and development, an argument can be made that they are both processes. According to Vygotsky, "creativity is fundamental to the development of all individuals…through the study of the interweaving of creativity and development, people's true natures are revealed" (Sawyer et al., 2003, p.63). Therefore, researchers should not view creativity and development as separate entities but instead as an integrated whole. Vygotsky felt that creative imagination introduces something new into the flow of our impressions, the transformation of these impressions such that something new emerges (Sawyer et al., 2003).

Creativity revolves largely around the idea of divergent thinking, otherwise termed as thinking outside the box. Divergent thinking involves unusual association of ideas, changing perspectives, and alternative approaches to problems. This way of thinking is contrary to convergent thinking that instead involves linear, logical steps.

(Sawyer et al., 2003) According to Robert Steinberg, some ways in which to design for creativity are to question and analyze assumptions, encourage idea generation, encourage sensible risk taking, encourage tolerance of ambiguity, cross fertilize ideas, allow for mistakes, and imagine things from other points of view (Sawyer et al., 2003).

In an attempt to define creativity beyond divergent thinking, the following collaboration of phrases have been presented: breaking up old ideas, making new constructions, enlarging limits of knowledge, making sudden and astonishing connections, and getting away from the commonplace and obvious for purpose of adventure (Honig, 2001). The creative process blends together powerful ideas such as freedom, frustration, inventiveness, anxiety, joy, and fantasy which all flow into the influences on development (Doyle, 2001). Just like child development, children's creative endeavors do not always have a definite beginning, middle, and end and therefore an ongoing dialogue needs to be maintained between the creative and developmental processes.

Appropriate Design for Children

By studying children as persons and seeking designs that are appropriate, the researcher implies a view of children as sentient beings who act with intention and as agents in their own lives (Greene & Hill, 2005). This method of research respects and promotes a child's entitlement to being considered as persons of value and persons with rights (Greene et al., 2005). Two main cognitive development theorists, Piaget and Vygotsky, regard the child as an active participant in constructing knowledge (Greig,

Taylorand & MacKay, 2007). With this in mind, it becomes important not only to research multiple aspects of children but to also take into account the perspectives and thoughts of children themselves.

Taking a look at the theoretical frameworks for scientific research with children, a debate emerges between positivism and constructivism avenues. The positivist approach is considered as a quantitative method (Greig et al., 2007). It assumes that the nature of children can be measured under scientific procedures. In this process, researchers seek to establish truth through controlled and systematic procedures (Greig et al., 2007). Positivism thrives off of numerical data collection and stems from more strict scientific fields. Constructivism, on the other hand, follows a more qualitative approach. This method involves description and interpretation that develops from a "contextualized holistic examination" (Greig et al., 2007, p.48). Researchers using this process feel that children are subjective and self-determining.

A qualitative research approach is appropriate for doing research with children because the natural environments such as classrooms and playgroups are ideal scenarios for study (Greig et al., 2007). Children prove to be great sources regarding the type of data that is key to qualitative methods. Researchers often capture children's experiences through rich, descriptive words and images (Greig et al., 2007). Children are also typically open and interested in becoming involved with the research process and therefore, the nature of this participative approach works well with a qualitative method. In general, approaches that are key to researching children's experiences and perspectives include holistic researching, open-ended questioning and observation.

Developmentally Appropriate Practices

Developmentally appropriate practice refers to the idea of applying child development knowledge to a framework and philosophy for working with young children. Based on the work of Piaget and Vygotsky, this approach places constructivism at the basis of intellectual development and highlights child-initiated, teacher-supported activity as an essential component (Gestwicki, 1990). Participants in this practice use the actions and experiences of children to guide their work. In their observations, they record objective and nonjudgmental facts about the child. The goal is to collect descriptions of what was communicated both verbally and nonverbally without interjecting subjective opinions into the records (Gestwicki, 1990).

Based on three key characteristics of Developmentally Appropriate Practices, activities, materials, and experiences should all be age appropriate, individually appropriate, and culturally appropriate. With this in mind, open-ended materials work as appropriate agents to support and encourage creativity, decision-making, and original thinking. Initiative and self-esteem are promoted through materials that offer no right or wrong uses and these objects provide for variations in individual abilities (Gestwicki, 1990). Through observation and dialog with children regarding their relationship with objects, participants in this practice gain insight that can later be used in further educational experiences.

Observation Techniques

Observation serves as a valuable teacher for designers considering that needs become more apparent through use and activities (Friedberg, 1970). Some prominent

techniques for observing in early childhood classrooms include running records, anecdotal records, and ABC narrative event sampling. The running record is a continuous observation of behavior for a particular period of time. The goal of this technique is to gather as much raw data as possible without interpretation (Nicolson et al., 2002). Anecdotal records capture a specific incident in a short, concise, nonjudgmental narrative regardless of time structures or settings (Nicolson et al., 2002). In ABC narrative event sampling, the observer focuses on an event, activity, or behavior or interest (B). The observer records the occurrence of an event and then notates the antecedent event (A) along with the consequence event (C) (Nicolson et al., 2002).

Due to the quick and brief nature of anecdotal record taking, this observation method proves efficient and effective in regards to researching children and their experiences. The focus of these short records is a specific event or action that has been identified as significant in some manner according to the researcher (Nicolson et al., 2002). These notes prove most reliable when captured immediately after the event has taken place. Otherwise, the memory of the observer may not be clear and detailed. The purpose of this observation technique centers on the notion that the researcher only needs to capture the essence of what occurred. In a journalistic sense, they are recording who, what, when, why and how. The child's behavior, actions and reactions should guide the documented observation. The anecdotal record should not only include a description of the event but also direct quotations from the children and the capturing of their gestures (Nicolson et al., 2002).

Focus Group Research

Moving beyond direct observation of experiences, another qualitative method in the study of children is focus group research. The origins of focus group research can be traced back to Bogardus who believed that groups promoted the stimulation of ideas that might be neglected in one-on-one interviews (Hennessy & Heary, 2005). Focus group discussions involve a small number of participants and the aim of the session is to gain insight into these participant's experiences and perceptions. In the case of product design, this method of research may inform decisions and identify alternative courses of action (Stewart & Shamdasni, 1990). In most cases, these discussions are lead by a moderator who strives to keep the group focused on the topic of interest and clarify any responses that may seem ambiguous.

The questions used in focus group research follow an open-ended method. The structure for questioning develops from general to specific with the intent to foster conversation and interaction between the participants (Hennessy et al., 2005). Guided by an open-ended approach, the questions should avoid yes or no answers and instead promote extended dialogue that leads to further discussion topics.

Recording methods for focus group discussion include audiotaping, note taking and observation. The researcher should concentrate on capturing group dynamics, non-verbal behaviors, emotional climate, enthusiasm of participants and individual reactions to issues discussed (Hennessy et al., 2005). According to experts Kruger and Vaughn, this qualitative data should be analyzed in four stages. First, an initial reading of the transcript and notes should take place in an effort to summarize major themes. Next, the

researcher should look for units of information that can be used in categorization. Categorization of these information segments should then develop according to common features. Last, the resulting categories should be compared to the beginning themes (Hennessy et al., 2005).

Practice: Montessori and Reggio Emilia

Research on and with children not only plays a role in academia but is also found in everyday routines of certain child-care and learning environments. Programs have been fully developed to feed off of the ideas and actions of children themselves. In these practices, adults act as guides and facilitators while children take a role in determining their learning and growth development. This type of curriculum set-up can be seen in both the Montessori Methods and the Reggio Emilia Approach.

Maria Montessori believes that children's minds are not divided into categories, but instead, they operate as whole systems. Just the same, the universe does not function in divided subjects (Montessori, 2004). For these reasons, as our minds dive into one area of study, it automatically spreads into another. The Montessori method emphasizes exploration, order, imagination, manipulation, repetition, and control. More specifically, the approach concentrates on sensorial exploration and symbolic representation. Montessori divides the development of children into three planes: sensorial explorers, reasoning explorers, and humanistic explorers (Montessori, 2004). In all three planes, children are encouraged to use material objects in interrelated ways. As explorers, the facts are of less interest to the child than the way that those facts are discovered. This method provides for a strong foundation for further learning.

The Reggio Emilia approach has its roots in the preschools and childhood centers in Northern Italy and is strongly influenced by the work of Piaget and Montessori. The drive behind this method lies in the idea that "every child is a creative child, full of potential, with the desire and right to make meaning out of life…" (Gandini, Hill, Cadwell & Schwall, 2005, p.1). The child is understood as both an interactionist and a constructivist. According to this approach, an "alphabet" develops as the result of interaction between child and material, leading to the notion of the "hundred languages of children" (Gandini, et al., 2005). For this reason, materials become vehicles for expressing ideas and communicating thoughts that are interweaved into their learning experiences as opposed to products that can be separated. In the words of Loris Malaguzzi, founder of the Reggio approach, the right of a child is "to be recognized as both source and constructors of their own experience, and thus active participants in the organization of their identities, abilities, and autonomy, through relationships and interactions with their peers, adults, ideas, things…" (Gestwicki, 1999, p. 324).

The review presented in this chapter brings together literature pertaining to interactive design, play, child development, and child educational/design practices. Each of these topic areas adds a unique perspective to the design development of a product for preschool children. Through the merging of these subjects, the researcher hoped to create a diverse base of knowledge that would prove beneficial to decision-making and evaluation further in this thesis study.

CHAPTER III

METHODOLOGY

Operating as a design thesis, the methodology guiding this study followed three main avenues including a product design generative process, case study observations, and focus group interviews. These avenues corresponded with the goals of developing a product, completing initial testing of this product and collecting feedback on the design from outside professional resources. The Methodology section presents a synopsis of these procedures while the Analysis section will follow with a more detailed discussion concerning reasons behind key design decisions and interpretation of both observation and discussion session data.

Design Process

In order to develop a distinctive solution to children's product design, the creative process departed from a linear design method to a more exploratory process that presented the opportunity for challenging usual typologies. The intent was to create a product or system of products that encouraged preschool children to take partial ownership in defining the objects' function and meaning. The design investigation began as form experimentation and incorporated iterative cycles of sketching and ideation. This exploration materialized through both two-dimensional and three-dimensional media but concentrated mainly on physical and digital modeling leading to full-scale prototypes.

The intended user and context for the designed product served as the basis for the primary parameters and guidelines for the process. Users for the design are preschool children between the ages of three and five years. For the context, the researcher chose non-residential settings focusing on preschool classrooms and childcare facilities. This choice influenced the designer's selection of parameters regarding dimensions, safety factors, forms, functions, and materials. These guidelines were used to help direct design iterations developed through the creative process. The factors for filtering, however, were used mostly in the design development stage, allowing the designer to freely explore three-dimensional forms without constrictions during the schematic design phase.

A typical design process, in general, consists of phases. The phases included within this thesis investigation were conceptual or schematic exploration, refinement or design development, solidification of materials and concepts, and prototype production. Throughout each of these phases, the design process was evaluated through desk critiques and studio reviews. During these reviews, the designer received feedback from both faculty and peers within the department of Interior Architecture.

Schematic Exploration

Based on theory reviewed in the literature, a goal of this form study was to focus on the creation of abstract and versatile forms. For this reason, the procedure for generating design ideas began with a free-association, open-ended approach. The designer attempted to explore forms independent of pre-conceived archetypes associated with adult product design. The first phase of ideation began through clay modeling with form qualities based on characteristics of action verbs. This approach explored free

flowing, biomorphic forms independent of scale or material constraints. These forms were evaluated through several desk critiques in which informal conversations were held between the designer and peers. More details of this feedback will be discussed in the Analysis chapter to follow.

The next stage in development became slightly more structured, as the model making material progressed from clay to various densities of foam. Idea generation, again, was a main focus in this design phase. Foam models became more rigid and geometric due to reasons discussed further in the analysis chapter. A focus on the manipulation of solid geometry began to emerge as the generator for further design ideas and exploration. The size of these models remained small for purposes of efficiency in producing multiple ideas and iterations in a short amount of time. The designer used woodworking tools along with hand-held tools to shape and sculpt the foam forms.

Design Development

With the aid of departmental professors and fellow students, the ideas that had been generated, up to this point through physical models, were filtered through a studio critique setting. Based on feedback from this mid-semester review, the designer progressed to digital modeling through a computer program called SketchUp as a means to efficiently consider scale, anthropometrics, dimension and interaction as the generative process continued.

After several more weeks of digital ideation, the designer held informal discussion sessions with both the thesis committee chair and the studio professor. Suggestions were made to the designer in regards to selecting two strong design ideas

from the ideation process. These two paths became the focus for further development. The two design avenues, playfully named “Flippy” and “Slidy”, were refined with respect to anthropometry regarding children, production material, function possibilities, and a proportional dimensioning system. The building of full-scale prototypes then followed.

Prototype Build

Prototypes for these two systems were made from rigid blue insulation foam. This polystyrene material was selected based on its ability to be easily machined. The foam was purchased in sheets of three-inch thickness that were later laminated together to achieve the desired form dimensions. Due to the need for lamination, the designer re-modeled the component forms in SketchUp in order to determine measurements and proper layer formats. After all layers of a form were cut out, they were then glued together using an industrial spray adhesive and sanded for further tactile refinement. The hinges needed in the “Flippy” design were simulated using a double layer of clear duct tape.

Following a final studio critique and more research attention given to safety considerations, a more refined prototype of “Flippy” was constructed. The layers making up each of the eight component blocks were delaminated. Each piece was then cut down proportionally in size based on further modeling and dimensioning in SketchUp. The designer then re-laminated these newly cut layers to re-form the eight component blocks. The blocks were again sanded to a desired smoothness and corners were rounded. In preparation for testing, each block was coated with several layers of white, elastomeric, latex paint.

Throughout the entire design process, the development of ideas was recorded through visual documentation. Physical models were photographed, hand drawings were scanned, and Sketch-up three-dimensional models were saved as digital images. Notations were also made during the process to capture important design decisions and the reasoning behind them. These documents will be discussed further in the Analysis section.

Case Study Observations

Upon the completion of a working prototype, the researcher arranged a case study approach to testing the design with preschool children. Through UNC-Greensboro's department of Human Development and Family Studies, the university has set up a childcare program with multiple sites located on the campus grounds. The Curry Annex preschool classroom served as a valuable testing site in this research process. The teachers and administrators provided guidance in working with and observing children of this age, while the overall program facilitated a relationship between the researcher and participants. This particular classroom was selected primarily based on the ages of its students and the openness toward research within the program.

Prior to any in-classroom testing of the design, the researcher was obligated to follow all necessary procedures in regards to obtaining permission for human-participant research. Through the Office of Research Compliance at UNC-Greensboro, the researcher completed required paperwork that was then reviewed for validation. A parental consent form along with a letter of support from the Curry Annex preschool

classroom were both drafted by the researcher in compliance with the IRB process. After several revisions, the application was approved and the research was cleared by the review-board.

In order to begin the testing and observation sessions, the researcher confirmed with the classroom teachers times and days that would best suit their schedule. The testing took place on three separate occasions within a week. The first session began on a Wednesday at 7:30am and lasted until 11:00am. The next session followed on Friday from 7:30am to 12:30pm. The final session took place on Tuesday after an extended weekend and ran from 7:30am through 11:30am. The ending times were dependent upon when the students were scheduled for outdoor activities.

Each morning of a testing session, the eight white blocks were placed at random inside of a designated indoor block play area. The only instructions given by the classroom teachers related to safety concerns about throwing and jumping in an indoor environment. During the testing session, the researcher sat or stood nearby in order to observe the play activity and interactions. Due to the fact that this preschool classroom operates in conjunction with a University system, the children in general are not phased by outside individuals watching them and taking notes. The researcher recorded the observations through both anecdotal written records and still images captured through photography. With the data collected, the researcher documented actions, gestures, body language, and direct quotes as they related to play with the designed blocks.

The goal of these observations was to collect data in three areas. First, the investigator took notes on whether participants repeated forms and arrangements that

were created with the blocks, or continuously sought out new combinations and orientations. The second focus for observation regarded the type of play (motor, pretend, etc.) that was elicited by the presence of the blocks. The final area of interest concerned the addition of other play materials to the designed play system. The researcher documented play that was solely dependant on the white blocks versus play that included additional classroom toys.

After each of these observation sessions, the researcher transcribed the written notes and records into more coherent sentences and bullet points. The data was then compiled and analyzed. The photographs were also reviewed for additional information and perspectives. Similarities and differences were noted in an attempt to formulate a cohesive analysis of the case study testing.

Focus Group Discussions

While the designer received comments from departmental faculty and students during the design process, the feedback from these internal reviewers was naturally biased. External reviewers became essential to strengthening the validation of the play system design. In an attempt to gather this external evaluation, three focus group sessions were added to the study. These sessions were structured around specific topic areas and encouraged the active exchange of ideas regarding the product design at hand. The formula for these meetings followed the characteristics of an open-ended conversation or interview. The researcher encouraged the respondents to participate in a directed discussion, allowing them to raise questions of their own in return. These meetings

followed a qualitative research method providing the researcher with narrative data that needed to be filtered and categorized.

The first focus group consisted of three childcare professionals all related to the Curry Annex division of the UNC-Greensboro childcare program. Due to the fact that all three participants observed, to some degree, children interacting with the design, this group had the most knowledge of the overall study. The interview took place in their office, during naptime hours for the children and lasted for forty-five minutes. The researcher served as the moderator for this small group, directing the conversation from a pre-developed list of questions and topics (Appendix A).

The second focus group included two area design professionals. Both of these participants are practicing in the field of product and furniture design. In this meeting, the researcher again served as the moderator for discussion due to the limited amount of participants. The session lasted for one hour and took place in the graduate studio space for the department of Interior Architecture at UNC-Greensboro. This location was selected based on easy access to the prototype of the designed play system. Before a feedback discussion began, the researcher presented background material, on the study, to the participating designers. Printed still images helped to illustrate the previous design process and testing observation sessions. The discussion was again guided by questions and topics that were established by the researcher prior to the meeting (See Appendix A).

The final focus group consisted of child development experts, representing both professors and graduate students in the Department of Human Development and Family Studies. Held also in the graduate studio space for the department of Interior Architecture

at UNC-Greensboro, this session lasted for one hour and fifteen minutes. The researcher served as the moderator and presented a brief overview of the thesis study to the group before questioning and further discussion began. Appendix A lists the questions used to establish topics of interest for this group.

Data collected from all the observation and focus group sessions provided for a qualitative analysis of the play system design as a whole. Through the compilation and analysis of this data along with findings revealed during the generative design process, the researcher connected commonalities in regards to effective design of interactive products for children. The visual and written documentation of this study details the development and growth of a product design from ideation to first-round testing and critique.

CHAPTER IV

ANALYSIS

Following the set-up from the Methodology section, the Analysis was divided into three categories: the design process, case study observations, and focus group interviews. The results from the design process documented models, renderings and prototypes in a chronological fashion, while detailing factors that influenced key decisions made along the way. The analysis from the case study observations interpreted both photo documentation and written notations. Finally, notes taken during the three focus group sessions were categorized for comparison purposes.

Design Process

In the Methodology chapter, it was noted that a typical design process is subdivided into stages of development. For purposes of this analysis, the design process was divided into two phases of schematic exploration, three phases of design development, and a final studio review evaluation with post review refinements. Evaluation of the design through earlier critiques was also discussed within each of the phases.

Schematic Exploration: Phase One

The generative process for this project began primarily as a form study. This meant that form characteristics were given the highest priority, putting aside

considerations for material, size, and function. For this type of investigation, the designer determined that the creation of these forms should be done in a three-dimensional context from the start. Through this hands-on approach, the designer could model three-dimensional shapes and immediately study them from all possible angles and perspectives. Therefore, one model could illustrate the information acquired through several perspective drawings.

Initially, three-dimensional models were sculpted out of Plasticene, a non-hardening clay. To provide the designer with some sense of conceptual foundation, action words served as a base for these first sculptures. The designer wrote verbs that may be associated with child's play on separate pieces of paper. Among the verbs included were burrow, jump, twirl, assemble, rotate, join, relax, conceal, grasp, push, and stack.

Figure 1: Verbs Associated with Play

The designer would then randomly chose one of these verbs and sculpt a form inspired by the word. The intent was not to create a shape that would facilitate a child to perform these actions but instead the form itself would reflect qualities of these actions. As can be

seen in Figure 2, the resulting clay forms for the most part were spontaneous, free flowing and non-linear. The forms were biomorphic while expressing movement and change. The clay modeling material added a level of plasticity and softness.

Review: Schematic Exploration Phase One

After producing twenty-two clay iterations, the designer collaborated with fellow students to evaluate the forms as potential play products for children. This collaborative discussion is otherwise known as a desk critique in the culture of design review. Through these informal discussions, the designer attempted to link the gestures within the clay forms back to key ideas in literature such as divergent thinking. Reviewers concluded that the level of ambiguity within the forms would most likely work positively in promoting imaginative and abstract thinking.

While addressing the potential dimensions of these sculptures, it was determined that the clay forms acted as single unit structures similar to what might be understood in outdoor playground equipment. In other words, each of the shapes illustrated a stand-alone, single, independent play object. This direction seemed to be leaning toward a more static design product in which the user would have few opportunities for manipulation and design change. Referring back to the research literature, the designer concluded that the forms needed to encourage more interactions, therefore leading to a new transition in the design exploration phase.

Twist

Rotate

Balance

Climb

Figure 2: Selection of Clay Forms Inspired by Verbs Associated with Play

Schematic Exploration: Phase Two

After experimenting with these clay forms, the designer continued the ideation process but transitioned to foam as a modeling material. The non-hardening clay proved to be beneficial in producing a number of schematic forms at a fairly rapid pace but the designer concluded that the material did not lend itself well to more linear and geometric forms. Literature reveals that preschool-age children begin to differentiate between rectilinear and curvilinear forms. For this reason, the designer felt that exploration through both linear and non-linear shapes would be appropriate and should not be limited by the chosen modeling material. Due to the fact that foam may also possess qualities of flexibility and softness, the designer chose this material for the next ideation phase. The designer was not only able to continue the generative process but was also able to experiment with various densities of flexible and rigid foam that would contribute to later research regarding prototype and final production methods.

In order to create a more interactive product, the ideation phase that occurred after the clay models focused more on a series of individual components that could make up a play system. Instead of a single-unit design, the goal at this point was to bring together multiple units to make a whole, a system. The intent of using this design approach was for the design to become better suited in promoting cognitive development and strengthening gross motor and problem-solving skills. With this new perspective, the designer also explored ways of connecting these components, as can be seen in Figure 3. This task became a challenge. A goal of the project was to leave the design as open-ended as possible so that preschool children could interpret it freely. As different

connection possibilities were explored, the methods for these connections began to dictate correct and incorrect assembly. Wanting to avoid this notion of a correct design configuration, the designer had to evaluate and filter out forms which provided too much scripted direction to the users. Overall, it was decided that designs in which components could only be connected in one, predetermined way would either be eliminated or re-designed.

Review: Schematic Exploration Phase Two

Following a mid-semester studio critique with department professors, the ideation process transitioned into a digital mode. It was suggested during the pin-up review that scale and connection methods between components be further considered from this point forward in the design process. A fair amount of exploration had taken place in regards to form study, but the relationship between these forms and the desired user could not be distinguished.

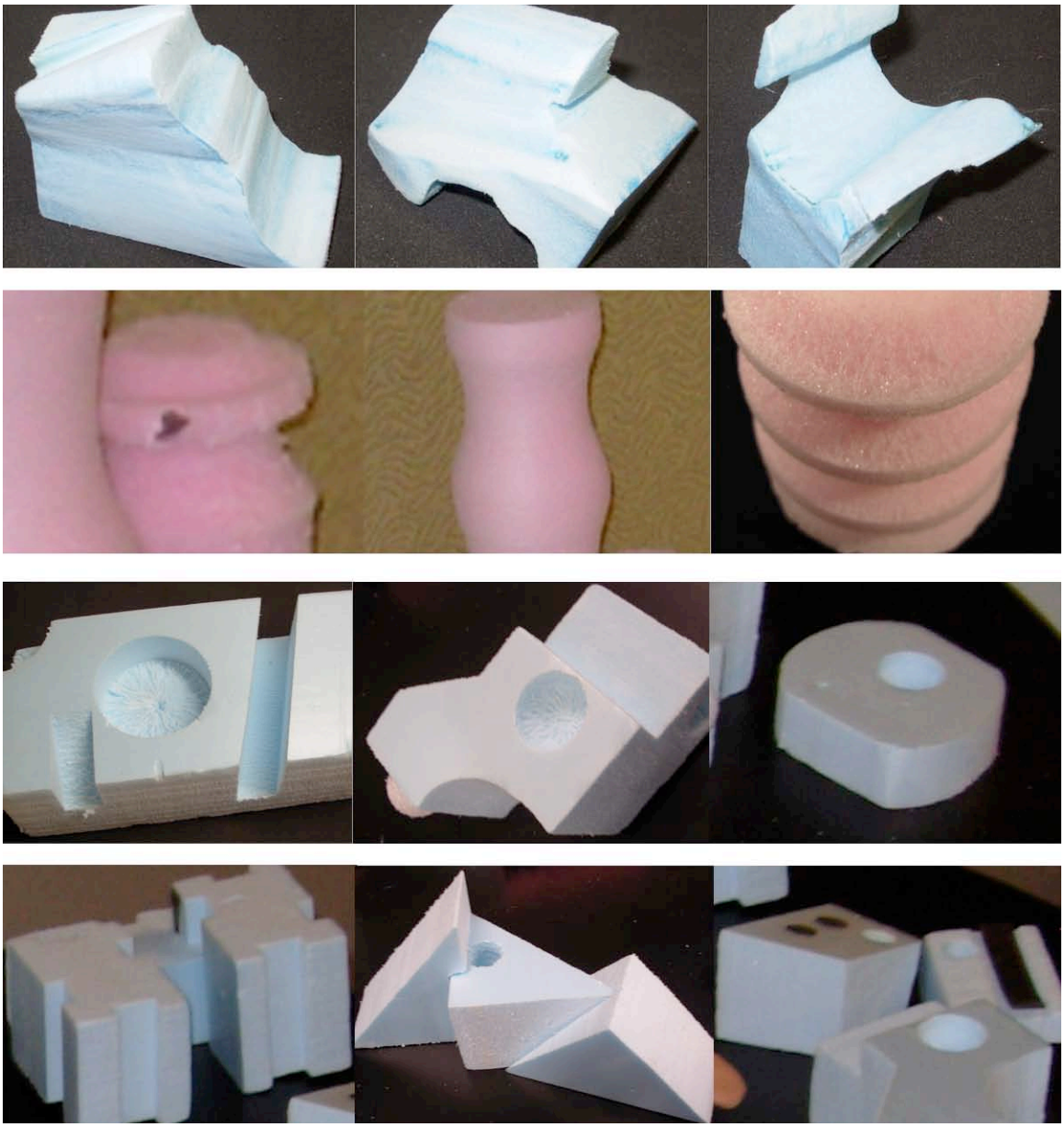


Figure 3: Selection of Foam Models Exploring Components and Connections

Design Development: Phase One

Instead of designing completely through physical modeling, the designer incorporated digital model making into the process. SketchUp, a computer design program, allowed the designer to continue form exploration while also integrating dimensions and functions as criteria. Until this stage of the generative process, forms had been sculpted devoid of consideration for scale and anthropometric data. Through SketchUp, the designer was able to quickly place a scale figure into the digital model, providing a reference for further evaluation.

Exploration of component parts making up a system for play continued through the use of digital modeling. Figure 4 shows that the designer worked both with iterations that included connecting pieces and those that did not. Some proposed ideas for connections included magnets and Velcro along with more puzzle-like solutions involving interlocking slots, grooves, and indentions. At this stage, the designer focused on the manipulation of solid geometry to create forms. The intent behind this approach was to achieve a greater balance within the design itself. According to the literature, this balance could be achieved by creating simple gestures that relate back to common sense and ease of assembly. The idea was not to limit the design, and therefore the users, to basic geometric forms such as the cube or sphere. Instead, the designer used these iconic forms as a basis for alterations and unique combinations. Literature, regarding current-day designs, revealed that irregularity of modular components leads to individuality of form. With this in mind, the manipulation of basic geometry helped increase the number of possible component connections.

Through SketchUp, the placement of scale figures next to these design forms revealed potential interactions between the design and its user. For example, the rendering of a child figure holding an "I" shaped form in Figure 4 helps to illustrate the potential for lifting these components and manipulating their physical positions and in turn developing gross-motor skills. The digital images in the bottom row of Figure 4 show child figures in both seated and standing positions. These perspectives indicate the scale of the play system and the possibilities for the user to stand on top of individual components or to crawl through the system itself.

Review: Design Development Phase One

Following further desk critique discussions and evaluation from both departmental peers and professors, the designer narrowed the form explorations down to two design schemes for purposes of refined development. The two design paths were labeled "Slidy" (Figure 5) and "Flippy" (Figure 6) and were both composed of eight component pieces. These paths were chosen based on the positive responses they both received from classmates and professors. In critique evaluations, "Slidy" was considered flexible and adaptable. Its interlocking components seemed to provide a level of stability needed for safety purposes. Reviewers also commented that its puzzle-like form seemed to have potential for intellectual areas of child development. "Flippy" also scored favorable during critique reviews, mainly regarding the uniqueness of its design. Evaluators were intrigued by the variety of configurations that could exist all while the system remained physically connected as a whole.

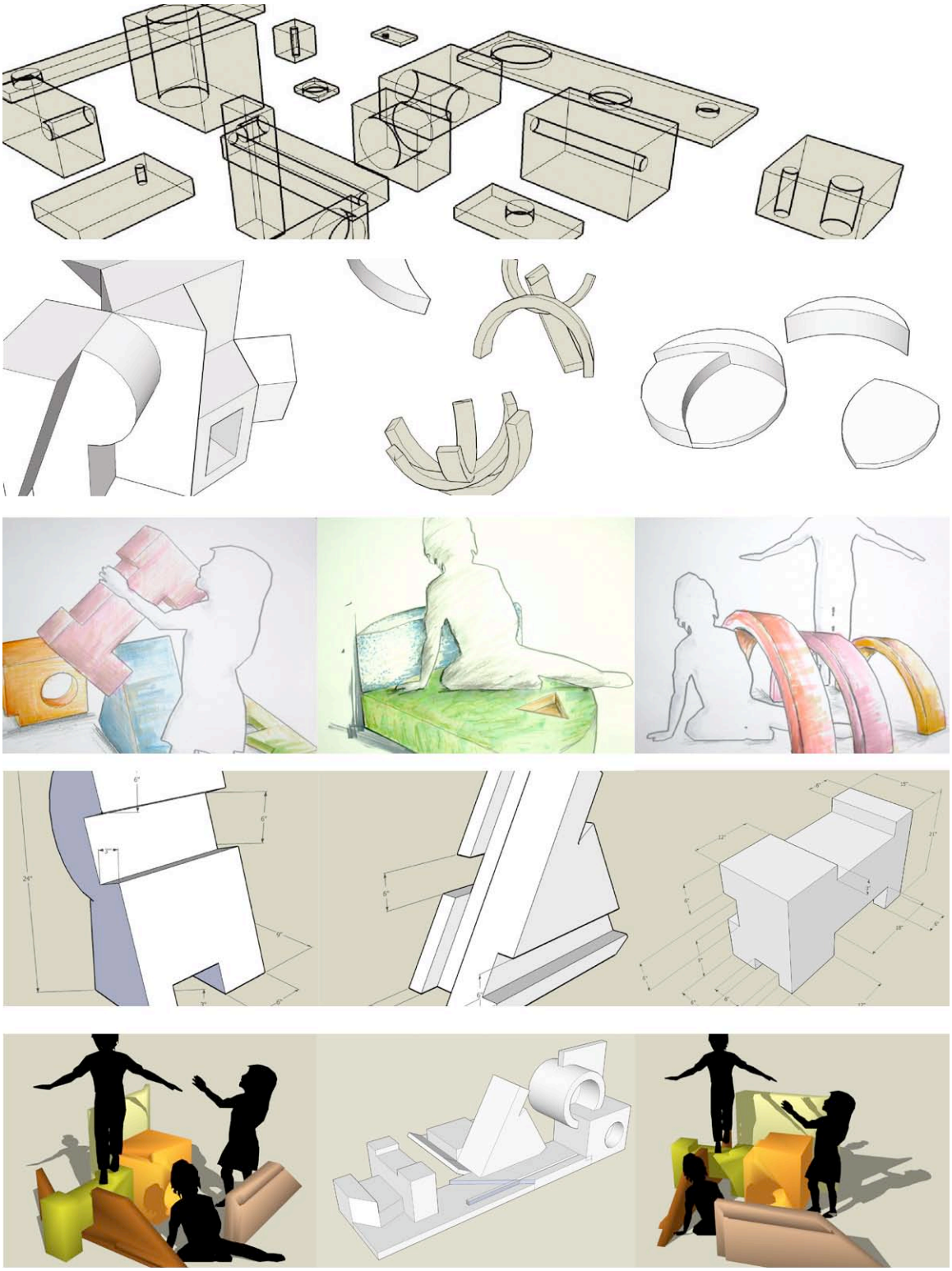


Figure 4: Selection of SketchUp Digital Models Incorporating Potential Scale and Function

Design Development: Phase Two

In this phase, factors such as child anthropometry and safety guidelines were acknowledged and used to help guide further decision-making. Some of the most relevant data regarding developmental measurements of preschool children and the guidelines to assure their safety have been charted and otherwise noted in Appendix B.

As mentioned before, "Slidy" (Figure 5) performed similar to puzzle pieces. Each component block had at least one groove cutout from it. These grooves measured three inches deep and six inches wide, creating a uniform design. The projected and recessed elements of the eight blocks would then interlock to connect the pieces as a system. In the "Slidy" design path, every component block could be used individually, or could be combined with other components in smaller or larger groupings. This characteristic allowed for extended flexibility. The slot and groove design approach itself limited the user only slightly in dictating how components could be connected while contributing positively to cognitive and problem-solving development. Even though the cutouts did suggest the exact location of component connections, the standardization of the cutouts allowed for every component to group with every other component in the play system.

The "Flippy" (Figure 6) design path took inspiration from a puzzle toy that could be flipped into multiple orientations. With this design, all eight components were connected at all times and could not be separated into individual block pieces. The components were joined through strategically placed hinges. The attributes of this design path pushed social interaction among children. With hinges connecting the entire system together at all times, size and weight became a factor. In order to change the position of

the components, users would be encouraged to work together for a common goal. The hinges in this design path did limit manipulation possibilities that could otherwise occur, but the function of these ambiguous play landscapes remained fully open for the user to define.

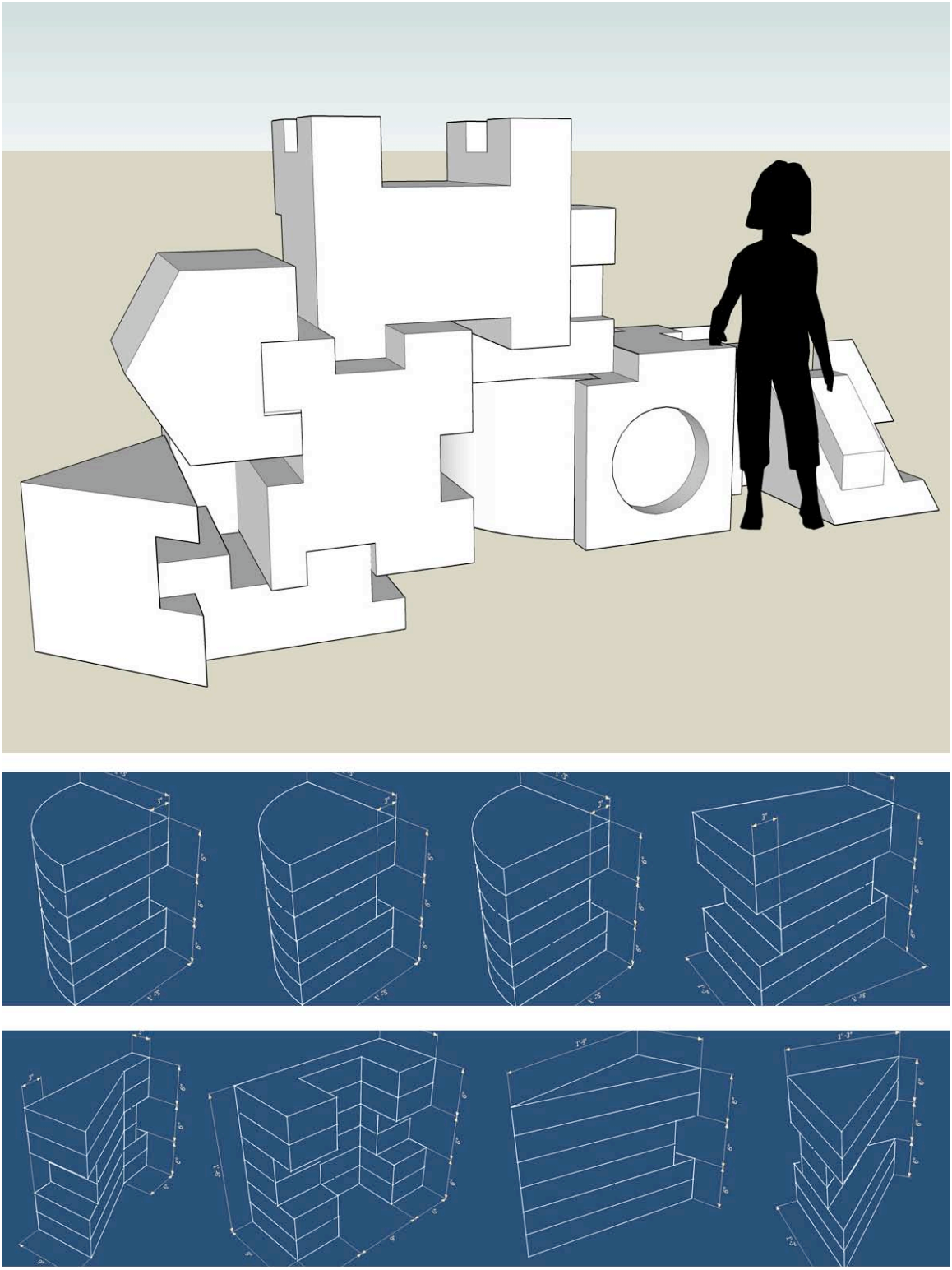
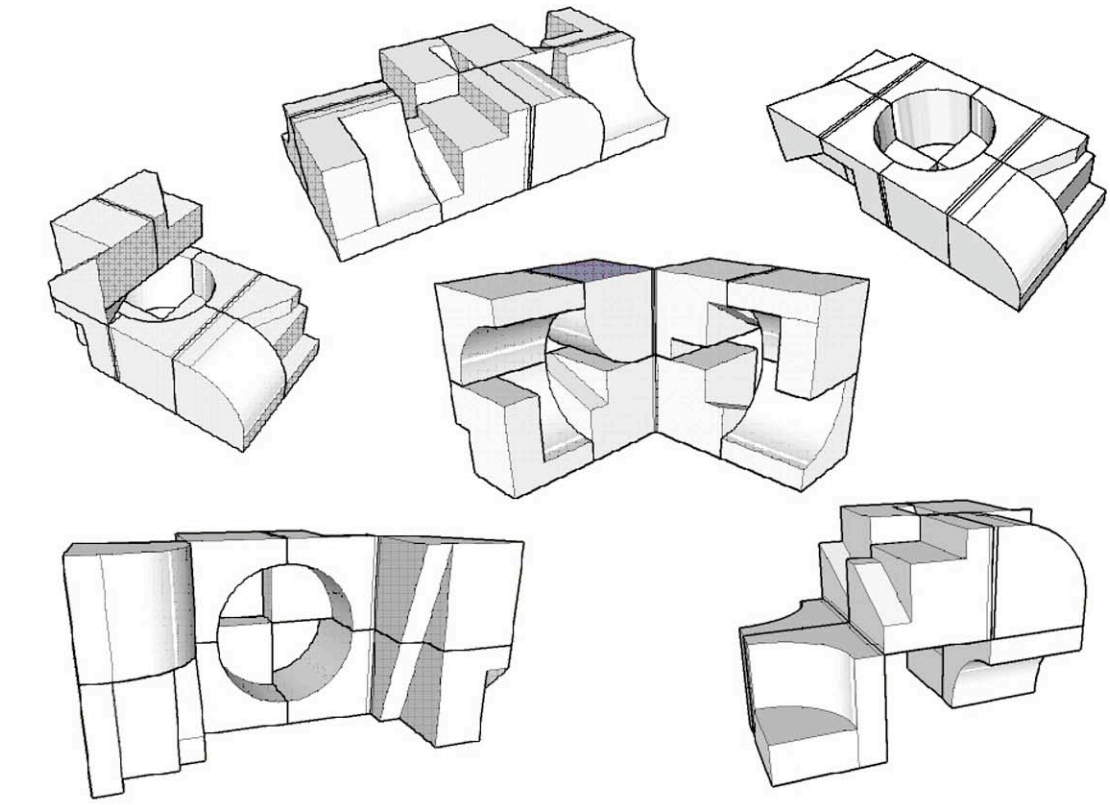


Figure 5: “Slidy” Design Path



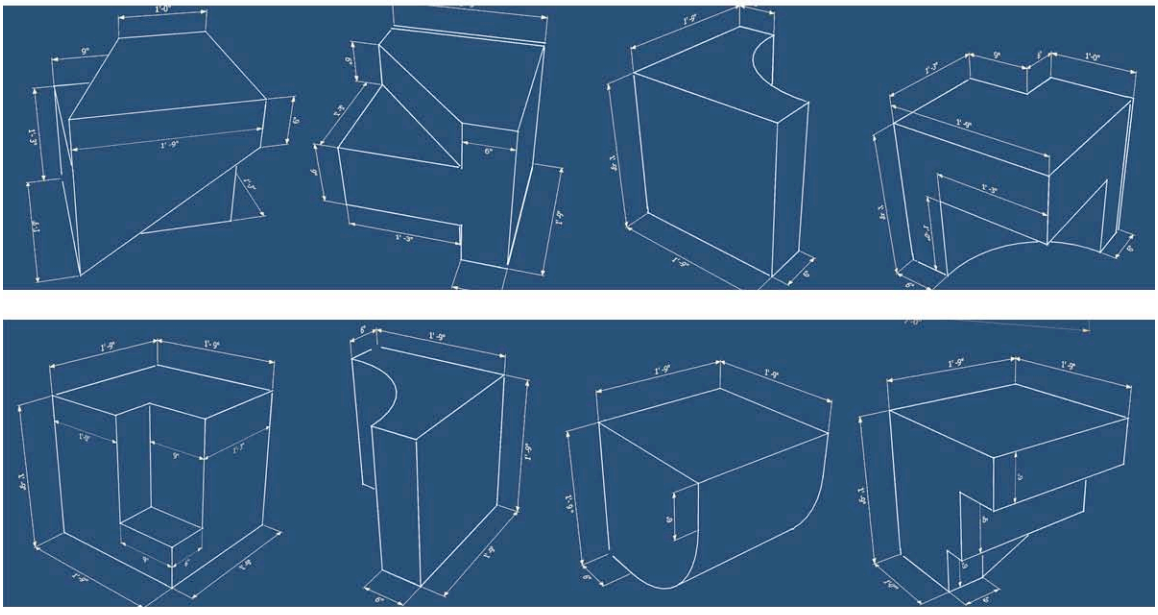


Figure 6: “Flippy” Design Path

Design Development: Phase Three (Prototype)

Most of the design development for both "Flippy" and "Slidy" emerged through digital media. As refinement continued, the designer determined that a full-scale physical prototype would aid in further evaluation of the form explorations. The design approach of "Slidy" was overall straightforward. It was not a difficult task to imagine the block components at a larger scale and to comprehend how the system would operate. "Flippy", on the other hand, seemed to be slightly more puzzling in regards to how the hinge mechanisms would function on a larger scale. For this reason, along with the designer's greater interest in its resulting forms, "Flippy" was selected for a full-scale prototype build.

At the beginning of this phase, the designer researched varieties of material foam and their corresponding manufacturing processes. Density and firmness quickly became key factors in choosing an appropriate foam type for children to climb on. The designer also researched coatings and fabric coverings for the foam components. Self-Skinning, Polyurethane foam proved to be a viable possibility in regards to stability, durability, and safety factors. A quote for a professional production of a prototype in this material, however, revealed that the cost for simply one component form would exceed four thousand dollars. For this reason, the designer decided to take on full responsibility for making a prototype of the play system.

Due also to cost constraints and availability, the designer chose blue insulation foam as the build material. This high-density material did not accurately simulate the resilient, give effect that was intended through slightly softer, flexible foam, but it did

still provide for a lightweight, easily machined material. In purchasing the insulation foam, the designer discovered that the thickest dimension available for this material was three inches. Therefore, in order to achieve thicker dimensions in the build, layers of the blue foam had to be laminated together. With the help of SketchUp, each component block was divided into three-inch layers. These layers were cut individually and then later glued together to build the eight blocks (Figure 7).

Even during the prototype build stage, design development continued to progress. Initially, the proposal was for each block to be formed from a twenty-four-inch cube. As the build began, the designer evaluated the scale and weight and decided to reduce these measurements to twenty-one-inch cubes. The designer also decided to eliminate a fabric covering and instead use clear duct tape to simulate the connecting hinges.

Figure 7: Flippy: Full-Scale Prototype Build

Final Studio Review & Post Review Refinements

The completed prototype of "Flippy" was critiqued based on potential function, scale, and overall appropriateness in regards to design for preschool children. The design, in general, received positive feedback in regards to uniqueness of user experience and form development. Based on feedback, the scale of the system distinguished the product from a toy. The forms strongly supported the concept of creating a play environment versus the simple grouping of components.

It was argued that the scale of the blocks remained too large. The size seemed slightly awkward for young children to manipulate. The height of the blocks also proved to be an issue when considering the climbing interest of children this age. The hinges were questioned in several regards. First, this design approach surfaced safety concerns. The hinges created pinch points and openings that might present further safety risks. The hinges also kept all eight blocks connected and therefore weight of the system as a whole became an issue. In addition, function was questioned in the critique. While the hinges allowed for unique configurations, they ultimately limited possibilities for the end user.

From this feedback, the designer engaged in a second round of prototype construction. The hinges were removed from the design, leaving the eight component blocks as individual elements. Even though these components were no longer physically connected, they still held a strong formal relationship to each other and could therefore still function successfully as a system. Due to safety concerns and scale appropriateness (Appendix B), the size of the blocks was reduced to eighteen-inches. The layers in each block were delaminated and cut down proportionally. The designer then re-laminated

these layers using an industrial strength spray adhesive. Again, for safety reasons, the designer also rounded all outside corners with a router. Once this stage of the build was complete, a coating was applied to the insulation foam for purposes of user testing. Four coats of an elastomeric white paint provided a subtle rubbery exterior (Figure 8). For purposes of later discussion, the eight blocks within the play system were assigned alpha-numeric labels. Figure 9 shows the assignment of these labels.

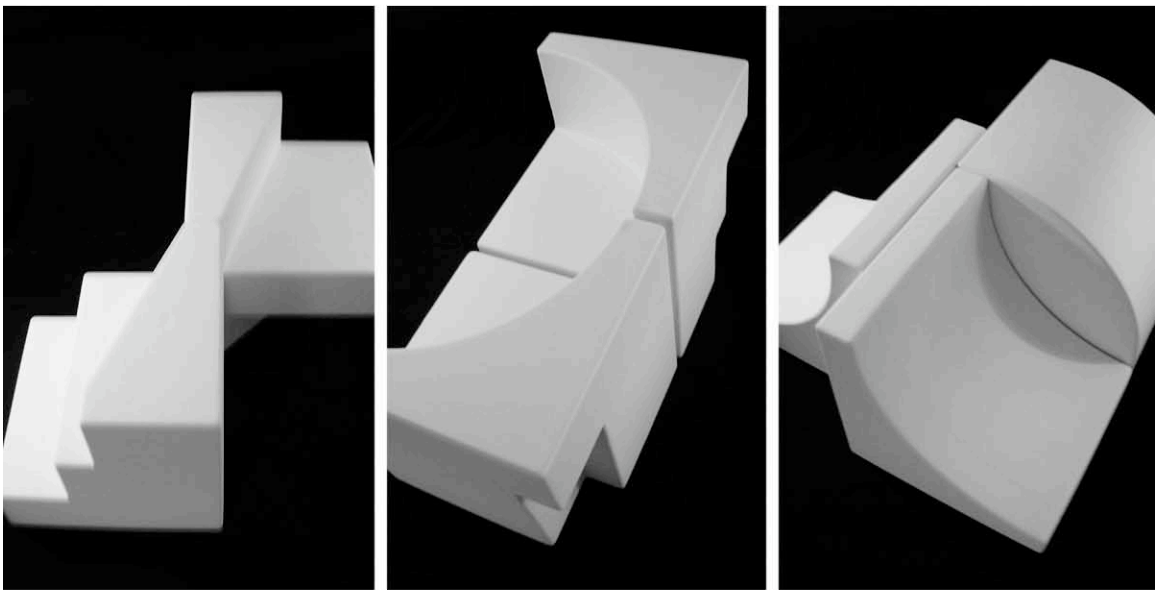


Figure 8: Final Prototype of Play System

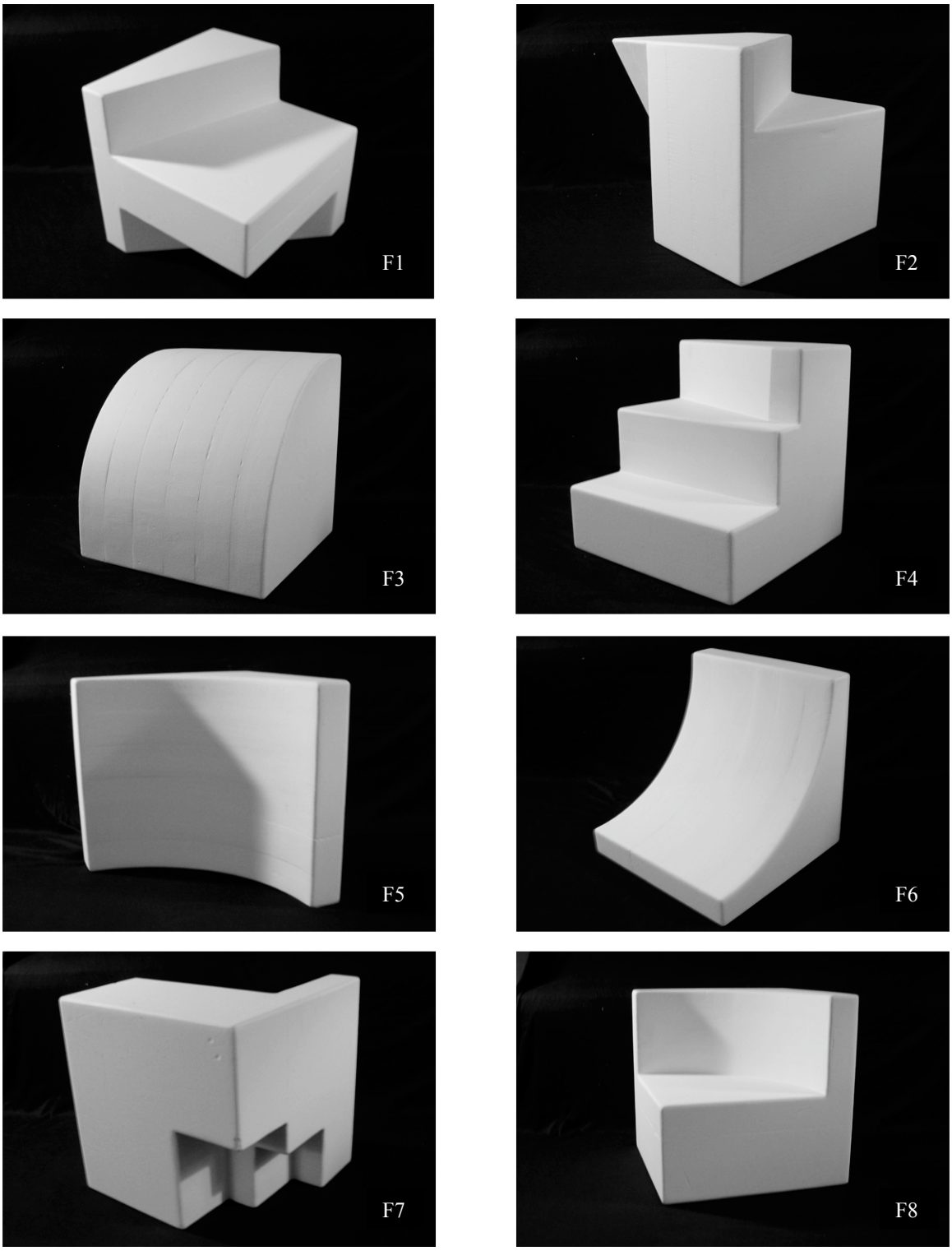


Figure 9: Individual Components of Final Play System Design

Case Study Observations

Upon completion of the second prototype build, the researcher arranged for three, case study, testing sessions through an on-campus childcare facility. The Curry Annex preschool classroom consisted of eighteen children between the ages of three and five. The group of children was representative across both gender and race. The childcare program itself often catered to research studies within the university and its teachings focused on child-initiated lessons. For these reasons, this setting proved ideal for initial testing of the designed play system.

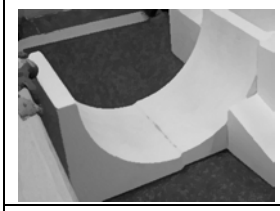
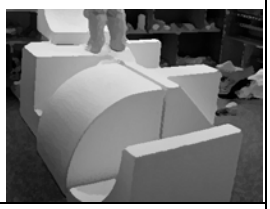
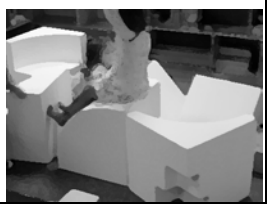
During the testing sessions, the researcher's observations focused on three main areas of interest. First, recordings were made of repetition versus originality with respect to the types of forms and combinations that the children made with the play system. The researcher wanted to note when the children used the blocks in the same manner and when they created new ideas for function and meaning. The second area of interest focused on children's play with the block system solely versus their play that incorporated both the block system along with other classroom materials.
Finally, the researcher collected data concerning the type of play that was occurring while the children interacted with the play system.

The analysis of this testing phase will focus on these three categories of interest. Support for concluding arguments come from both the written notes and the photographs taken during the observations. These supporting notes and photographs can be referenced in Appendix C.

Repetition vs. Original

From the three observation sessions held during this study, the researcher found overall, that the children interacted with the play system in original manners more frequently than they did in repetitious ways. For the most part, the children participants were highly engaged in rotating, flipping, and sliding the block components around the play area in order to achieve newly desired configurations. A break down of some key repeated and original ideas can be viewed in Table 1 below.

Per analysis of written notes and photographs, the researcher identified three forms and/or themes that were repeated most often. The "ramp" consisted of blocks F5 and F6 combined in a semi-circular formation. Despite the fact that the children were drawn to this shape repeatedly, they did use the form in a variety of ways. Some children sat in the "ramp" while others used it as a mini-slide. The participants also rolled toy cars up and down the slopes. The "automobile" configuration acted as another frequent formation during the play sessions. In this scenario, children would use block F3 as the front section of an automobile, while adding blocks F5, F6, F7, or F8 for seats and doors. The variation in this theme emerged when the children defined the automobile as a car, truck, etc. The last major repetition that surfaced across all three sessions of observation involved an "obstacle course" set-up of the blocks. The children would arrange the eight blocks separately in a circular pattern within the play area. The participants would then exercise their gross motor skills by jumping and crawling from block to block. In this situation again, the orientation and placement of the individual blocks were not always the same but the function of this arrangement was repeated.

Table 1	Block Combinations
Repetition	**Original**
 "ramp": children arranged these two blocks in this manner repeatedly for purposes of sitting, sliding, relaxing, and rolling toy cars	"hot tub": small group of children isolated all blocks with a curved element and arranged them together to create this form 
 "automobile": children repeatedly placed the convex curved block in front of a concave block for purposes of making a car, truck, etc.	"playscape": two children collaborated in bringing together all eight blocks to produce this arrangement 
 "obstacle course": children repeatedly arranged individual blocks separately in a circular form for purposes of gross motor play	"office chairs": two children preparing for pretend office play chose to stack the blocks two-high in order to create two desk chairs 
	"playscape 2": small group of children work together to use all eight blocks and produce this linear arrangement 
	"cuddle zone": two children prepare to play house and bring the blocks together in order to form this enveloped space 
	"playscape 3": children use majority of the blocks to create a form that provides for multiple levels of sitting 

Block Play vs. Block Play with Additional Materials

Within this category of interest, the objective was to decipher whether the designed play system alone would be adequate for manipulation and exploration or if preschool-age children would bring other play materials to the blocks for play enhancement purposes. After reviewing data collected through observations, the researcher concluded that analysis supports both scenarios but for the most part, the participants desired to extend their play themes with other classroom toys. A breakdown of these two scenarios is illustrated in Table 2 below.

Overall, it appeared that the children used the designed block system to initiate play themes. As they moved, rotated, and grouped the blocks, the participants would develop themes for pretend play. In some cases, solo blocks were used independently for play. For example, block F1 functioned as a horse and block F6 acted as a slide. More often, however, the children gathered the blocks into groups of two or more. These groupings created environments and within this creative process the resulting forms and combinations were given meaning and function. Figures 10 and 11 illustrate examples of these types of groupings.

Figure 10: Grouped Blocks Create “Hot Tub”

Figure 11: Grouped Blocks Create “House”

As the basic themes of play were decided during reconfigurations of the white blocks, children chose to embellish these themes with toys from outside the block area. These other materials included items such as toy laptops, cars, animal figures, measuring tapes, wooden blocks, and fake flowers. The outside play materials seemed to bring an element of realism to the abstract forms of the blocks. For example, children added laptops and a coffee maker to the arrangement of white blocks that were serving as a play office environment. Children also added these additional materials when their build projects required smaller elements such as the wooden blocks or rope for rescue purposes. Figures 12-16 illustrate some scenarios in which children combined the white blocks with other classroom toys.

Figure 12: Combined Play with Wooden Blocks

Figure 13: Combined Play with Laptops and Coffee

Figure 14: Combined Play with Toy Animals

Figure 15: Combined Play with Wooden Blocks

Figure 16: Combined Play with Toy Cars and Animals

Table 2	System Plus
Play designs made w/ block system	**Play w/ block system + other materials**
Tunnel	Wooden block ramps for racetrack
Curve	Wooden block back seat for truck
Ramp	Pretend play with dress-up toys
Seesaw	Electronic PC Fun Game
Look-out platform	Small toy characters to climb
Car	Fork for poking holes in blocks
Racetrack	Construction toys for pretend play
Snowmobile	Wooden blocks for build of doghouse
Slide	Fake flowers and petals for funeral
Stairs	Toy animals for walking on blocks
Chair	Wooden blocks stacked on top of blocks
Roof of doghouse	Soft measuring tape for rescue lines
Truck	Soft measuring tape for dog leash
Rollercoaster	Tape measurer used to measure blocks
Motel	Toy cars to roll up and down blocks
Boat	Stuffed animals to walk on blocks
Construction site	Old laptops and coffee maker for office
House	Old camera for office play
Water slide	Microphone for office play
Funeral gravesite	Hat and glasses for disguise
Castle	Wooden blocks as barrier
Bed	Kitchen timer as alarm clock for family
Drums	
Concentration corner	
Horse	
Dog park	
Rock	
Jail	
Office / Desk	
Mountain	
Motorcycle	
Mechanical horse	
Stage for show	
Gymnastics course	
Dance class	

Types of Play

In reviewing data pertaining to this area of observation, the researcher noted that children's interaction with the designed play system was dominated by social experience. Due to the scale of the blocks along with the newness factor to the classroom, the white blocks attracted groups of children who developed their play with and alongside of their classmates. It proved rare for the researcher to observe play activity with the blocks through only a single child. When this scenario did occur, it only lasted for a few minutes before additional children would join.

Aside from social interactions, the two main types of play that the researcher observed and documented were gross motor and pretend. Some examples of these two play types are categorized in Table 3 below. Gross motor interactions with the blocks seemed to be promoted by the size of these eight components. The various cutouts from these eighteen-inch blocks encouraged actions such as climbing, stepping, crawling, and jumping. As children worked to manipulate the position and orientations of these components, they also developed their skills in pushing, pulling, and lifting.

Observations of pretend play were recorded through direct quotes from children. These direct quotes (Appendix C) were paired with other written notes and photographs in order to determine when fantasy or pretend play was occurring. As participants created forms from the play system, they would often orally communicate to their peers what function these forms should take on. For example, after placing several play blocks together, one child directed to another child, "come in my race car…hey, we have to close the door…you need a door too."

Table 3	**Types of Play**
Gross Motor (physical)	**Pretend Play (fantasy)**
Lifting block in air	Driving car with family
Jumping from top of block to another block	Racing cars on a racetrack
Climbing across tops of blocks	Playing the drums
Sliding down sides of block	Riding a horse
Swaying back and forth on top of block	Running as dogs in a dog park
Crawling across blocks	Sailing in a boat
Pushing blocks into place	Rescuing people from the water
Pulling blocks into place	Swimming like a mermaid
Stepping up onto blocks	Locked in a jail
Laying down on top of blocks	Working in an office
Sitting on top and sides of block	Climbing on top of mountain
Standing on top of blocks	Looking out for danger as sea captain
Rocking on top of block	Playing family: mom, dad, sister, brother
Whipping side of block	Acting as dogs, cats, horses
Rolling toys on blocks	Burying friend at funeral
Dancing around blocks	Watching t.v. as husband and wife
Twirling like ballerina	Working as child's dad and dad's boss
Curling up body to snuggle	Battling between toy action figures
	Riding a motorcycle
	Performing in a show
	Dancing as ballerinas
	Conducting a dance class
	Playing sick
	Playing house
	Living as princess in castle

Focus Group Interviews

In addition to obtaining feedback from preschool children through the case study testing and observation sessions, the researcher chose to seek feedback from adults as well. In order to achieve this, the researcher identified three groups of professionals that would relate to the design study in some manner. These groups were made up of area design professionals, childcare professionals, and child development experts. The author felt that each of these designated groups would bring forth a unique perspective in regards to critiques and evaluations of the play system. While all three groups were exposed to similar questioning, each group definitely defined a unique path of discussion.

The product design professionals were mostly interested in discussing methods of production and marketing. While these topic areas did not fall within the highest priorities of this study, the researcher was certainly grateful for this perspective and the foundation that this information laid for future research. Due to this focus, the questioning feedback from this group often tied back to material, packaging and identity.

A focus on scale emerged from the focus group session with childcare professionals. Members of this group stated that the Curry Annex preschool classroom was large in comparison to typical classrooms of this nature and therefore they explored possibilities of outside use, fewer numbers of components, and sharing among multiple classrooms.

The child development experts directed much of their discussion on the form of the blocks. Participants desired more puzzle-like fittings in the components for purposes of stability and storage. They appreciated the abstraction of form within the eight blocks

but felt that the blocks should relate more strongly to each other. Members also proposed that the cutouts from each of the components be included as part of the system as a whole.

During each of the three focus group sessions, the researcher documented conversation through written notes that can be reviewed in Appendix D. After sorting through these recordings, the data was categorized into three larger themes. These themes consisted of form, scale, and material. The researcher then broke these broader themes down into smaller, related subsections such as function, context, safety, production methods, etc. Comments from the discussion sessions were separated generally into categories of positive and negative remarks. After this task was complete, the researcher created Tables (Tables 4-6) that highlighted points made during the interviews regarding the themes and their subheadings and whether these points supported or critiqued the design. The information gathered in these Tables remains divided among the three focus groups. The area, product design professionals are labeled as DP. The Curry Annex childcare professionals are labeled as CCP. The child development experts, from UNC-Greensboro, are labeled as CDE. By creating separate columns for each of these groups, the remarks can still be easily traced back to their source.

Form

The first main categorizing theme was Form. Within the concept of Form, data was further separated into groups of function, iconic associations, packaging, production methods, and safety. The details of this information comparison can be viewed in Table 4 below.

Considering function as it relates to the form of the component blocks, all three focus groups commented positively. Overall, they felt that the shapes promoted a variety of uses and therefore would capture the attention of preschool children for extended amounts of time. A connection was seen between the designed forms and an educational/developmental value. Two of the groups were interested in further testing to uncover how the function of the blocks would change in different institutional settings following various curriculum programming.

The subheading of iconic associations refers to instances in which form can be strongly connected to functional shapes in an adult world. For example, while there are countless variations on the design of chairs, in general this functional icon carries with it very distinct and recognizable attributes. In the focus group feedback, the researcher wanted to identify any iconic associations that could be made relating to individual forms within the system. Two of the three groups did identify a chair form, but overall, the participants felt positively about the forms and did not consider them to dictate specific functions.

Participants viewed packaging in regards to form both positively and negatively. Some members believed that the basic block shapes would facilitate packaging needs while others argued that the blocks should fit together more easily to create one larger form. Looking at production methods, the design professionals commented to great extent on this topic stating that the simple nature of these forms proved ideal for rotational molding processes. In regards to safety, some individual forms elicited stability concerns for several participants across the board.

TABLE 4						FORM
	positive			negative		
	DP	CCP	CDE	DP	CCP	CDE
Function	-global market? -montessori / friends school -ties to educational value	-promote variety of uses -holds attention for extended length of time -changes in different institutions	-different shapes increase functionality -promotes problem solving skills -encourage social play			
Iconic associations	-chair: not seen as a bad thing	-more abstract forms	-shapes did not dictate function		-stair, ramp, chair	
Packaging	-easy due to basic block shapes	-sell in set with fewer number of blocks				-wanted shapes to fit together into larger cube
Production methods	-rotationally molded -hollow or solid					
Safety		-overall, stable enough for varied uses			-encourage active play -stability of single block	-concern for stability of blocks

Scale

In looking at the comments compiled for scale, the design received positive feedback regarding ergonomics and function, while raising concern under the subheadings of context, safety, and storage. A breakdown of specific comments in each category can be found in Table 5 below.

As stated previously, the proposed context for this play system is a preschool or otherwise similar childcare facility. With this in mind, participants strongly agreed that the designed play system was better suited for institutional settings versus a residential context. However, concern was stated about smaller classrooms and the availability of indoor play space for such large block components. Participants across all focus groups also raised doubt about the ability for this system to be stored easily indoors.

Scale in terms of user interaction and appropriateness scored favorable among participants. Members of the focus groups were pleased with the resulting dimensions. After viewing selected images from the preschool classroom observation sessions, participants felt that the scale fit proportionally to the child and did not cause any awkward encounters.

Most participants agreed that the scale of the design would promote both gross motor activity and social interactions. The size helps distinguish this product from the toy category while encouraging a range of both active and calm play. While gross motor development is crucial to preschool-age children, some members of the focus groups felt that this type of activity in relationship to the component blocks might cause unsafe practices when considering jumping and climbing actions.

TABLE 5						SCALE
	positive			negative		
	DP	CCP	CDE	DP	CCP	CDE
Context	-good for institutions	-good for large classroom			-problematic for small classroom	-space issue -outdoors might be better
Ergonomics	-seems appropriate	-fits to child dimensions	-good size, not awkward			
Function	-used in schools, daycares, hospitals -global appeal -adds level of sophistication	-promoted gross motor activity -different from toys & furniture -calm & active play	-gross motor play -promotes social interactions -intrigue from large block set			
Safety		-discouraged throwing & excessive stacking	-18" height of single block works well		-promoted jumping off top	-rule needed for no climbing on stacked blocks
Storage				-big for shelf space in stores	- too big for storage space	-size is issue for indoors

Material

Self-skinning polyurethane foam developed as the proposed production material for the designed play system in this study. In each of the focus group sessions, members were shown a sample of this material for better understanding. The participants also interacted with the prototype blocks and were encouraged to form judgments regarding this chosen material as well. In Table 6 below, the larger theme of material has been sectioned off into colorization, context, production methods, safety and function.

While color did not play a significant role within this design research, many participants showed genuine interest in the potential for color and what this attribute could add to the overall design. The material chosen for this study seemed appropriate considering its ability to be easily colorized during the production phase.

The subject of material with regards to production methods seemed to be mainly focused within the group of design professionals. These members stated the advantages of using liquid vinyl resulting in no seaming but also brought forward environmental concern when using a PVC coating.

The material chosen received high regards in connection with safety issues. Participants appreciated the lightweight characteristic and felt that the material could hold up well to routine cleaning. Members of the childcare professionals group did experience the durability issues with the prototype blocks but understood that the material used was simply representational. The lightweight attribute also facilitated lifting and general manipulation of the blocks, promoting physical interaction between the design and its intended users.

TABLE 6						MATERIAL
	positive			negative		
	DP	CCP	CDE	DP	CCP	CDE
Colorization	-ability to be colored	-interest in further color exploration	-potential use of color coding			
Context		-indoor & outdoor?	-indoor & outdoor?!			
Production methods	-dipped in liquid vinyl -no seams -self-skinning			-PVC coating harmful to environment		-could skin be penetrated by sharp objects?
Safety	-hold up to cleaning solutions -lightweight	-provides for soft surface & round edges -sturdy -lightweight	-good weight -seems like material could be cleaned easily		-prototype not durable enough	
Function		-promotes physical interaction -tactile stimulation	-appropriate for lifting and other manipulation	-density of foam determines function to some degree		

CHAPTER V

CONCLUSION

Literature reveals that objects in play that can draw children into action serve as a vital source for child development. The task, then, for the designer is to uncover what attributes of a design can successfully draw children into action. These desired attributes seem to logically connect with those found in interactive design. With this in mind, the concept of interaction became a key contributor throughout the entire process of this thesis investigation. The product creation process explored a range of three-dimensional forms designed to foster user interaction. Observations during testing revealed what kind of interactions could take place with the designed play system. And, finally, focus group sessions exposed potential benefits and consequences of these interactions. Analysis from all three stages, then, served to ultimately provide validation for this study and design outcome.

Design for Interaction

The overall product result from this thesis study proved very successful in achieving a high level of user interaction. The design embraced simplicity of form, yet encouraged opportunities for complex arrangements. The proposed solution promoted user choice and allowed the design to respond directly to the children. As children explored the play system, the orientation of the block forms did not limit their usefulness.

The simple lines, in fact, helped bring together the components in a variety of ways. Functioning as an expandable system, the design proved valid on two fronts. The component blocks could either be used individually as separate elements, or they could be combined into various group units and configurations.

Within the study, the designer was able to achieve, to some degree, flexibility. During the design process, the designer strove to maintain a level of abstraction within the forms. This became a challenge as the designer struggled to bring together a cohesive design without dictating function. The greatest difficulty arose when the ambiguous, sculptural forms created during the schematic exploration phase had to be refined according to child dimensions and safety guidelines. The abstract components of the final iteration contribute to overall versatility. The ambiguity of forms helps to eliminate a distinction between right and wrong interactions, therefore expanding the potential for varied arrangements and creative interactive play.

The design solution also promotes maneuverability. Even though the size of the component blocks is rather large, the convex and concave cutouts provide opportunities for grasping by small hands. The lightweight material, chosen for the play system, also helps to encourage manipulation. As children were able to move and rotate the components on their own, the need for adult intervention diminished giving children more control. While user control is an important aspect of interactive design, the researcher discovered that full control is only an ideal especially when concerned with the safety of preschool-age children.

The play system also succeeded in user interaction through the establishment of product meaning. During the testing observations, the researcher noted that children were able to create unique experiences through creative imagination and manipulation. As children constantly rearranged the play system, the components would take on personal meaning for each child. In some cases, children explored meaning and value on their own, but in most scenarios the interactions became a social experience, and therefore determining function became a dialog of compromise.

Interaction and Development

The testing sessions themselves provided the researcher with both benefits and limitations. Often times designers within an academic setting receive feedback from professors and peers, but never have the opportunity to truly try out their ideas with the intended user. Without this level of testing, the designer is denied of perhaps the most valuable critique. Through the support of UNC-Greensboro's childcare program, the researcher was able to integrate the refined prototype into an active preschool classroom. Data gathered through these observations was priceless in terms of validating hypotheses and exposing unforeseen interactions.

The nature of the participants within the case study also influenced the type of conclusions that could be drawn from the study. Attending a university sponsored childcare program, the children within this chosen preschool classroom were quite accustomed to participating in research studies. A benefit of this scenario came during the data recording process. The researcher was able to sit within the play space and take

written notes without disturbing the normal activity of the children. While this was a great opportunity, the researcher also had to consider the fact that these participants were challenged with creative endeavors on a daily basis and that the curriculum for the classroom was based on the interests of the children. With this in mind, further testing in other preschool settings would be beneficial before drawing more comprehensive conclusions.

The Curry Annex preschool classroom was used as a case study. While a case-study approach may be limiting, the observations that were made during this study illustrate that children were drawn to this play system and were actively engaged with the component parts. The size and weight of the blocks encouraged gross-motor activity, and therefore presented opportunities for developing physical skills such as lifting, balancing, and jumping. The system promoted social interactions. Observations revealed both parallel and cooperative play as children worked to define these abstract forms. Thus, the system design persuaded children to work together, compromise, and learn from each other. The challenge of giving function to these forms also promoted creative and cognitive development. The sheer number of play themes and the level of detail that occurred within this play emphasized the success that this play system design had achieved in bringing together interaction and child development.

Development of Design

Gaining feedback from professionals related to the thesis study was crucial to the completeness of this research. While observing children actually interact with the product

design itself accounted for one avenue of gathering data, collecting supporting information from a group of external adult reviewers added greatly to the overall understanding and analysis. Through open-ended discussions, the researcher collaborated with the focus groups in an effort to define potential benefits of product/user interaction. Overall, the professionals commented positively on the intent of the study and the play system solution. By organizing each interview group based on the expertise of the participants, the researcher gathered directed suggestions for further development of the design.

Three prominent paths suggested for future explorations included design for outdoor use, color experimentation, and production of product. Due to space and storage limitations, reviewers across the board recommended that outdoor use of the play system be considered. In order to accommodate for this proposed context, the design would need to transition in regards to material choice, durability, and safety guidelines. A divided debate over color for the play system occurred with study participants. The subject of color itself, therefore, presents an opportunity for a complete study of its own. And finally, reviewers throughout the study inquired about producing and marketing this design, leading to yet another potential area for further pursuit.

At the beginning of this thesis investigation, the researcher raised the question: can a designer influence child development through interactive design? The insights gained during the thesis process illustrate that attributes of the solution design certainly provide resources for social interaction, gross motor development, and imaginative play as well as creative and cognitive problem solving. The results and data collected simply

reflect the possibilities of one viable outcome. This outcome, along with its research foundation, does however illustrate the potential power of interactions between a product and its user.

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Appendix A.

Focus Group Questions

Focus Group Questions – design professionals
03.14.08

Overview:

1. Going back to the main idea behind my design…my overall intent is to create a system for play that allows its user to freely define its function and meaning through exploration and manipulation.

   In what ways can you see this idea materialized in these blocks?
   Do you see this design being something that preschool kids could interact with and take ownership of?
   Do the forms encourage exploration?

2. Looking at the forms of these blocks, and thinking about iconic associations to adult forms and spaces…can any of these shapes be strongly linked to a pre-defined function?
   Identify any functions and the characteristics of the component that lead to this association.
   Do you feel that any of the forms are too abstract?

3. Discuss from a design perspective how the scale chosen for the blocks facilitates or hinders exploration and manipulation?
   What activities does the scale limit?
   What activities does the scale promote?
   Do you consider this product a toy or does the scale change that category?

4. The proposed production method for this play system involves molds user to cast forms of self-skinning, high-density polyurethane foam. Do you feel that this method is appropriate for the design?
   a. Are there alternative methods that might be more suitable?

5. The intent of this product is to steer away from the trends of miniature-sized forms of adult products and instead present more abstract, simple forms. Based on your understanding of the current consumer market, do you feel as though this design would still be marketable?
   If no, what is lacking?

Overall…are there any other modifications that you would recommend or comments that you would like to make?

Focus Group Questions – child care professionals
03.17.08

Overview:

6. My overall intent is to create a system for play that allows its user to freely define its function and meaning through exploration and manipulation.

   In what ways can you see this idea materialized in these blocks?
   Do you see this design being something that preschool kids would want to interact with and take ownership of?
   Do the forms encourage exploration?

7. Looking at the forms of these blocks, and thinking about iconic associations to adult forms and spaces…can any of these shapes be strongly linked to a pre-defined function?
   Identify any functions and the characteristics of the component that lead to this association.
   Do you feel that any of the forms are too abstract?

8. Discuss from a childcare professional perspective how the scale chosen for the blocks facilitates or hinders exploration and manipulation?
   What activities does the scale limit?
   What activities does the scale promote?
   Do you consider this product a toy or does the scale change that category?

9. Based on your knowledge of preschool childcare facilities, do you feel as though this designed play system works appropriately in this context?
   How does scale play into its appropriateness?
   Do you feel as though the design speaks to all kids…(gender, race)
   If no, what is lacking? What modifications need to be made?

10. In regards to safety concerns, discuss how this product either meets or does not meet the standard guidelines for both this age group and a childcare facility.
    Scale?
    Cleanability?
    Material feel and weight?
    Stability?

11. Based on your understanding of the current consumer market for preschool play materials, what are your thoughts on this designs marketability?

Overall…are there any other modifications that you would recommend or comments that you would like to make?

Focus Group Questions – child development experts
03.27.08

Overview:

12. My overall intent is to create a system for play that allows its user to freely define its function and meaning through exploration and manipulation.

    In what ways can you see this idea materialized in these blocks?
    Do you see this design being something that preschool kids would want to interact with and take ownership of?
    Do the forms encourage exploration?

13. Looking at the forms of these blocks, and thinking about iconic associations to adult forms and spaces…can any of these shapes be strongly linked to a pre-defined function?
    Identify any functions and the characteristics of the component that lead to this association.
    Do you feel that any of the forms are too abstract?

14. Discuss how the scale chosen for the blocks facilitates or hinders exploration and manipulation?
    What activities does the scale limit?
    What activities does the scale promote?
    Do you consider this product a toy or does the scale change that category?

15. Based on your knowledge of preschool childcare facilities, do you feel as though this designed play system works appropriately in this context?
    How does scale play into its appropriateness?
    Do you feel as though the design speaks to all kids…(gender, race)
    If no, what is lacking? What modifications need to be made?

16. In regards to safety concerns, discuss how this product either meets or does not meet the standard guidelines for both this age group and a childcare facility.
    Scale?
    Cleanability?
    Material feel and weight?
    Stability?

17. Based on your knowledge of child development for children between the ages of three and five, what types of development might this designed play system promote?
    Gross motor?
    Cognitive / Intellectual?
    Creative?

Social?

18. Based on your understanding of the current consumer market for preschool play materials, what are your thoughts on this designs marketability?

Overall…are there any other modifications that you would recommend or comments that you would like to make?

Appendix B.

Anthropometry, Ergonomics and Safety Guidelines

Table VII

Handbook for Public Playground Safety
U.S. Consumer Product Safety Commission

9.1 Sharp points, corners, and edges	There should be no sharp points, corners or edges on any components of playground equipment
9.2 Protrusions and projections	Protrusions and projections on playground equipment should not be capable of entangling children's clothing
9.6.1 Head entrapment	An opening presents an entrapment hazard if the distance between any interior opposing surfaces is greater than 3.5 inches and les than 9 inches
11.3 Minimum elevation requiring guardrails and protective barriers	For preschool-age children: an elevated surface that is more than 20 inches above the protective surface should have a guardrail or protective barrier to prevent falls
11.7 Stepped platforms	Maximum difference in height between stepped platforms should be 12-inches for preschool-age children
12.1.2 Design considerations	Preschool-age children: offering an easy way out is particularly important on climbing devices intended for preschoolers, since their ability to descend climbing components emerges later than their ability to climb up the same components
12.1.8 Balance beams	Balance beams should be no higher than 12 inches for preschool-age children

Table VIII

Caring For Our Children
National Health and Safety Performance Standards: Guidelines for Out-of-Home Child Care Programs

PR14 Program activities for 3- to 5-year-olds	Opportunities shall be provided for children to observe, explore, order and reorder, make mistakes and find solutions, and move from the concrete to the abstract in learning
PR15 Program activities for 3- to 5-year-olds	Age-appropriate equipment for both indoor and outdoor play shall be selected for safety, for its ability to provide large and small motor experiences, and for its adaptability to serve many different ideas, functions, and forms of creative expression
PR17 Program activities for 3 to 5-years olds	A cooperative rather than competitive atmosphere shall be fostered. There shall be encouragement of verbal skills and attentiveness to the needs of individuals and the group as a whole
FA110 Play equipment	Toys must be safe, sufficient in quantity for the number of children, and age-appropriate
FA211 Additional indoor requirements for infants, toddlers, and preschoolers	Toys or objects that have diameters of less than 1 ¼ -inch, objects with removable parts that have diameters of less than 1 ¼ inch, toys with sharp points and edges, plastic bags, and Styrofoam objects shall not be accessible to children under 4 years of age

Table IX

Caring For Our Children
National Health and Safety Performance Standards: Guidelines for Out-of-Home Child Care Programs

Preschool Children – selected body dimensions (males and females)

	Age 3 - 3.5	Age 3.5 – 4.5	Age 4.5 – 5.5
Average Height	36.75 in	40.0 in	42.5 in
Average Vertical Reach	42.25 in	46.0 in	49.5 in
Average Chest Height	25.5 in	28.5 in	31.0 in
Average Hip Height	16.0 in	18.25 in	20.0 in
Average Hand Length	4.0 in	4.5 in	4.75 in
Average Knee Height	8.75 in	9.5 in	10.5 in

Table X

Play For All Guidelines
Planning, Design and Management of Outdoor Play Settings for All Children

9.1.1 Safety – hazard versus challenge	A hazard is the unforeseen consequence of a child's inability to handle a given challenge. It can result from a poorly designed feature which children see without comprehending the behavioral implications A challenge is something that a child can see and chooses to attempt
9.1.3 U.S. Consumer Products Safety Commission – use zone	The fall area is an area under and around the equipment where protective surfacing is required. For preschool and toddler play areas, this fall zone requirement should be applied to all play equipment over 20 inches high
9.1.4 Appearance considerations - theme	Non-thematic equipment is more adaptable for informal as well as programmed activity For most ages, the more abstract the thematic representation the more supportive the setting is for the imagination. Equipment should be designed to allow for a variety of dramatic play opportunities
9.8 Materials - plastics	Plastics are used to round corners and add soft coatings to otherwise hard surfaces. The most common is high-density polyethylene. It is used for rotational molded slides, panels, and spring mounted animals. It can also be used in injection molds as a "structural foam"
18.1 Empowerment: children making a place of their own	A physical environment that responds to a child's manipulations encourages exploration and discovery. Play props can be manipulated, put together, and torn apart. They are the ingredients that children use to make their own environments

Table XI

Handbook of Physical Measurements

Preschool Children – selected body dimensions (males and females)

	Age 3	Age 4	Age 5
Average Standing Height	36.8 in	39.9 in	42.7 in
Average Sitting Height	21.5 in	22.6 in	23.8 in
Average Head Circumference	19.6 in	20.0 in	20.2 in
Average Hand Length	4.4 in	4.7 in	4.9 in
Average Leg Length	19.0 in	21.0 in	23.0 in
Average Foot Length	6.0 in	6.4 in	6.7 in
Average Foot Width	No data	2.3 in	2.4 in
Average Weight	30.8 lb	35.2 lb	39.4 lb

Table XIIa

● MOTOR DEVELOPMENT ■ SOCIAL DEVELOPMENT ▲ LANGUAGE MILESTONES ○ COGNITIVE DEVELOPMENT

2.5 - 3 YEARS

- ● CANNOT TURN OR STOP SUDDENLY OR QUICKLY
- ● CAN JUMP A DISTANCE OF 15 TO 24 INCHES
- ● CAN ASCEND STAIRWAYS UNAIDED, ALTERNATING THE FEET

■ BEGINNINGS OF CONVERSATION; BREAKTHROUGH IN ATTENTION TO COMMUNICATION.

▲ NEW WORDS ARE LEARNED ALMOST EVERY DAY. COMPREHENSION IS EXCELLENT, ALTHOUGH CHILD STILL MAKES MANY MISTAKES IN GRAMMAR.

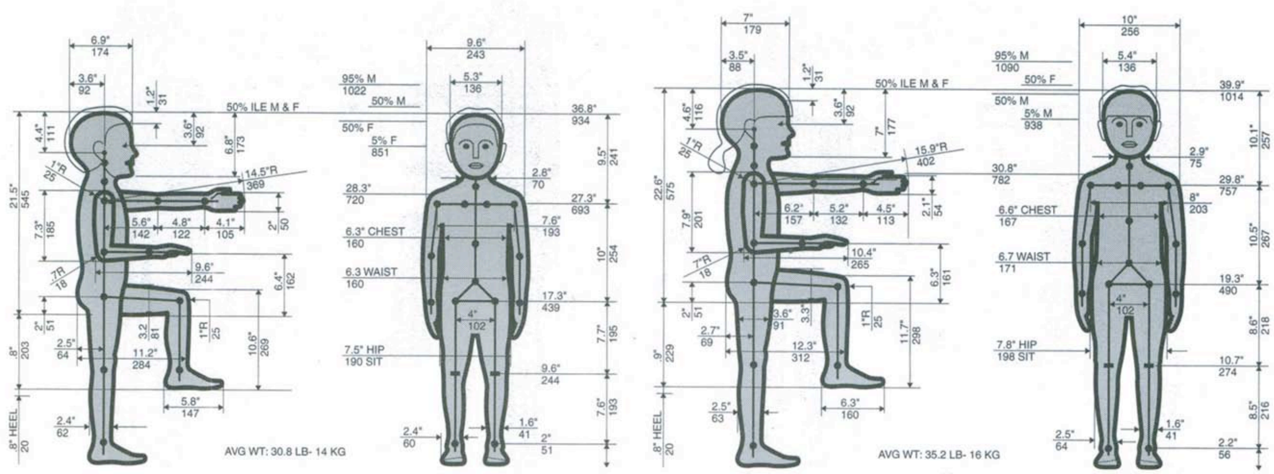
4 YEARS
GIRLS TALLER THAN BOYS

- ● MORE EFFECTIVE CONTROL OF STOPPING, STARTING, AND TURNING
- ● CAN JUMP A DISTANCE OF 24 OR 33 INCHES
- ● CAN DESCEND LONG STAIRWAYS ALTERNATING THE FEET, IF SUPPORTED

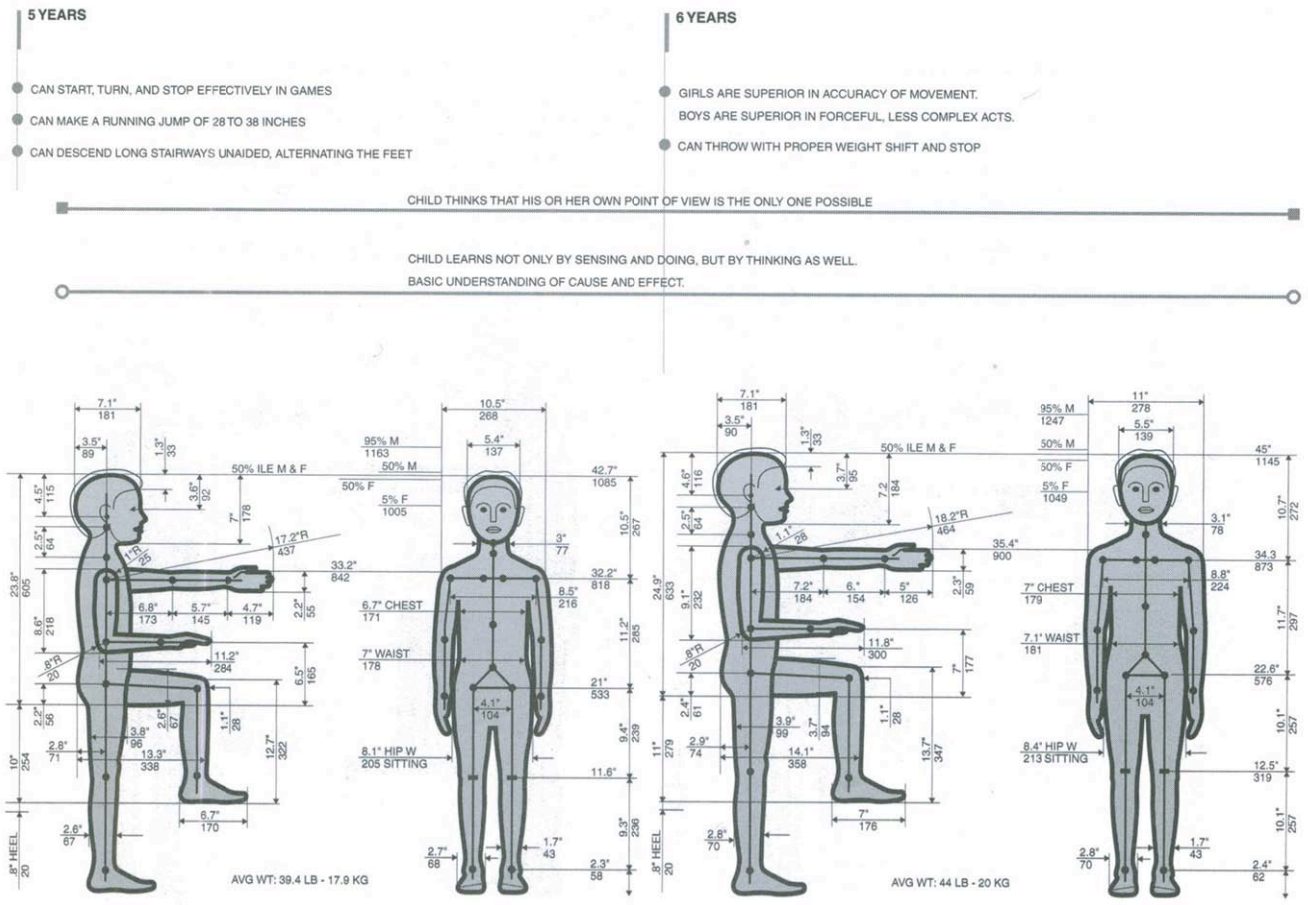
■ CHILD THINKS THAT HIS OR HER POINT OF VIEW IS THE ONLY ONE POSSIBLE

▲ VOCABULARY REACHES 1,000 WORDS, ABOUT 80% ARE INTELLIGIBLE. GRAMMAR IS CLOSE TO ADULT SPEECH, AND SYNTACTIC MISTAKES ARE FEWER.

○ GROUNDWORK FOR LOGICAL THINKING: CHILDREN CAN THINK ABOUT OBJECTS, PEOPLE, OR EVENTS IN THEIR ABSENCE BY USING MENTAL REPRESENTATIONS OF THEM, BUT THEY CANNOT YET MANIPULATE THESE REPRESENTATIONS.



MEASURE AND DEVELOPMENT OF TODDLERS—2.5 TO 4 YEARS



MEASURE AND DEVELOPMENT OF YOUTHS—5 TO 6 YEARS

Henry Dreyfuss Associates, The Measure of Man & Woman (Alvin R. Tilley, Ed.). John Wiley & Sons, Inc., New York. 2001.

Appendix C.

Observation Written Anecdotal Notes and Photographs

Thesis Observation Day #1
White Blocks
03.05.08

Location: the blocks were placed into the normal block area of the classroom. The teachers had expanded this location slightly to adapt to the white blocks. The squared off area was bordered on one side by a wall and the three remaining sides were low, waist height bookshelves.

Time Span: 7:45am-11:00am – for entire length of observation time, there was only a five minute interval (9:05-9:10) where no child was in the block area engaging in play with the white blocks

Rules: there were only three rules given to the children as they approached the block area. (**1**) no shoes should be worn while playing on the blocks. (**2**) no throwing the blocks. (**3**) no jumping off of the top of the blocks. For safety reasons, the teachers had made a rule for the normal play blocks that your feet must remain on the floor, but for the white blocks they agreed that they could be walked on as long as there was no jumping off of high places.

Direct Quotes:

"ooooh, I'm going to skateboard on that" - referring to the sloped block when I was first bringing all of the blocks into the classroom (boy)

"let's make a house…with stairs" – suggestion by one child as the group first began to bring the separate blocks together as a whole (boy)

"I am captain underpants" – announced / yelled by one child as he stood on top of a single block and raised his hand in the air (boy)

"just because it looks like a chair, but it's not" – ideal quote! Dialog between two children…one claimed that they should use the block as a chair because that is what it looks like while the other claimed that just because it looks like a chair doesn't mean that it has to be used as chair, and in fact it was NOT going to be a chair (boy)

"here, you sit on it…
no, it's not a chair! It's stairs…
oh, I didn't know" – dialog between two children…discussion between the correct use of a block as a chair or stairs (boy & girl)

"this is my ramp" – one child declaring the function of his creation and ownership over the collection of blocks (boy)

"no no, he only needs curves" – as two boys arrange the blocks to make a rounded enclosure, another child attempts to help and bring an outside block to the building process, but he was immediately informed that they were only using blocks with curves (boy)

"we're in the hot tub" – a child declares that the rounded enclosure is a hot tub (boy)

"you two guys don't break the car…ok" – said to his playmates as a boy had to leave the block area for his snack time (boy)

"we are driving in the car…I am the sister" – statement made by a girl when she was asked by a teacher what they were doing with the blocks (girl)

"let's make a rollercoaster" – suggestion made by a child as to what next to build with the blocks (boy)

"you're on my boat…my mom said , no go on the boat" – statement made during pretend play with the blocks (girl)

"your room is downstairs…this is how you get downstairs, let me show you…it's morning so you have to slide down there" – statement made during pretend house play with the blocks (girl)

"she is about to die
no, she has died already" – dialog between two children; funeral pretend play where child lies on blocks and is covered with fake flowers (boy / girl)

"I have to go back into the castle" – statement made during pretend play with the blocks (girl)

Play objects/environments made from blocks:

Tunnel
Cave
Ramp
Seesaw
Look-out platform
Car
Racetrack
Snowmobile
Slide
Stairs
Chair

Roof of doghouse
Truck
Rollercoaster
Motel
Boat
Construction site
Obstacle course
House
Water slide
Funeral gravesite
Castle
Bed

Toy play brought to white blocks:

-wooden blocks that were stored in the bookshelves in the designated block area were brought out to add ramps between the white block components in order to extend their elaborate construction of a racetrack for toy cars

-wooden blocks added to back of "truck" for a back seat, to front for steering wheel, and elsewhere for other miscellaneous car parts

-dress-up toys such as wings, boas, and headbands were brought over to the white blocks by three girls for pretend play

-PC FUN GAME was brought to the "car" set up, children were seated inside of car while they played with the electronic toy

-PC FUN GAME #2 was used by a single girl, she used the white blocks for both a seat for her and a table for the electronic game.

-small toy character with pointed hat was brought to block area…boy used point on toy to make small holes in the white blocks

-fork and knife from kitchen area were brought to the block area…boy proceeded to stab the blocks with the fork to make holes in the forms

-construction play toys (hammers, measuring tape, saw, etc.) were brought to the white blocks for construction pretend play

-wooden blocks were used to construct a dog house…one white block was added to the creation for a roof

-fake flower petals and leaves were placed on top of girl who was laying across white blocks during funeral play

-toy animals walk, jump, and fly between white blocks

Types of Play:

Physical / motor: constant rearrangement of blocks – push, pull, lift, jump, climb, slide, step, crawl

Pretend:

-sea captain looking out for danger
-family : mom, dad, brother, sister, dog,
-cars racing on racetrack
-dogs, cats and owners
-sailing on a boat
-funeral, burial
-wife and husband on bed watching t.v.

Thesis Observation Day #2
White Blocks
03.07.08

Time Span: 7:30am-12:30am – Friday was a rainy day so there was no outside play. Teachers took groups of children in the back hall for more active play but there remained children in the regular classroom for the entire 5 hours. In the second day there were more time spans where no children interacted with the white blocks but these lapses still did no last for more than 10 minutes at a time.

Direct Quotes:

"I'm taller than you" – as three children stand on top of individual blocks, one child announces that he is taller than his two other classmates (boy)

"I'm in the lead, look I am in front and you are behind…I won first and you won second" – two children are sitting in separate race cars that have been constructed using the white blocks and are pretending to be in a race (boy)

"come in my race car…hey, we have to close the door…you need a door too" – two children having a discussion as they construct a race car from the white blocks (girl)

"look at what I can do" – one child wanting to show off as he lifts a white block over his head (boy)

"a concentration corner" – a response by a child when asked what he had just built (boy)

"oohhhh…I want to do this again" – an exclamation by a child as he first walks in to the classroom and spots the white blocks (boy)

"giddy up horsey" – a comment by a child who is sitting on top of a block and rocking back and forth (boy)

"this is my seat and that is your seat…I need a bigger boat…
this is a part of the boat…
we're making a so big boat…
that's a good place because it has a window…
pretend I drowned when I came back out…
and when you weren't looking, I drowned, right?" – dialog between a group of children who had arranged the white blocks to form a boat and were pretend playing that they were sailing on the water (boy, girl)

"I'm a mermaid and this is my rock" – announcement by a child as she extends the boat play to include the sea around the boat (girl)

"exercising my feet" – response by child to a question of what she was doing as she slide her feet up and down on the ramp white block (girl)

"here's my bed, my bed is on top of the bunk bed" – two children had just assembled the white blocks together and decided that they had constructed beds (boy)

"we are big kids…we work at UNCG…we are student teachers" – dialog between two children as they sit on top of the blocks pretending to work on their laptops and drink coffee (boy)

"we go mountain climbing" – one child's comment as a group of children climb across the tops of the white blocks (girl)

Play objects/environments made from blocks:

Car
Race car
Drums
Concentration corner
Horse
Obstacle course
Dog park
Boat
Rock
House
Jail
Bed
Office / desk
Mountain

Toy play brought to white blocks:

-sewing tape measurer (3) brought to the blocks to twirl while standing on top of blocks

-sewing tape measurer used as leashes for dogs during pretend play where children acted as dogs

-wooden blocks were stacked on top of the stair white block

-sewing tape measurer was used as rescue devices to help pull drowning children to the safety of the boat

-wooden blocks combined with white blocks to make enclosure of the jail area

-sewing tape measurer used by girl to measure the lengths of the tops of the white blocks

-toy cars were brought to the white blocks to roll up and down ramps

-stuffed animals were walked across the tops of the white blocks and were thrown up in the air to see which block they would land on

-chop sticks and large fork were brought to the white blocks to poke holes in the blocks

-old laptop computers and coffee maker were brought to the white blocks during pretend play at office

-toy dinosaurs and other animals were lined up on top of the white blocks

Types of Play:

Physical:

lifting block in air,
jumping from top of block to another block,
stepping from block to block,
climbing across tops of blocks,
sliding down sides of block,
twirling off tops of blocks,
swaying back and forth like an airplane,
crawling,
pushing blocks into place

Pretend:

Driving car with family
Racing cars on a race track
Playing the drums
Riding a horse
Dogs running around in dog park
Sailing in a boat and rescuing people in the water
Swimming as mermaid
Locked in jail
Working in an office
Climbing on top of mountains

Social versus Individual play: most of the play with the blocks took place with two or more children. Exceptions were boy who stacked wooden blocks on white block, boy who played on laptop with only himself, boy who built concentration corner,

Thesis Observation Day #3
White Blocks
03.11.08

Time Span: 7:30am-11:00am – there were a number of time blocks were no children were playing on the white blocks. These time blocks lasted up to 10 minutes.

Direct Quotes:

"I'm passed out" – one child declared as he pretended to be sleeping on the two ramp blocks pushed together (boy)

"what if you said, come into my office?...
cause I was the principal, right?...
actually you are the boss…
what boss am I ?...
you are a worker boss, like my dad's boss" – dialog between two children as they set up the blocks to create a work environment with two offices.

"hey, we have the white blocks again" – child exclaims to another classmate as she is being dropped off in the morning by her parent (girl)

"let's pretend that you have to build your office…upstairs is my office" – continued dialog between two children playing pretend office

"I'm taller than you…
I know" – conversation between two children who are standing on top of the blocks competing to be the tallest (boy / girl)

"you can be our hair person…
well I'm rubbing his hair because he is my husband" – as two children sit on top of the white blocks, a third child came to join them and began rubbing the top of another child's head. One of the boys suggested that they play pretend hair cut but the girl only wanted to play family with husband and wife

"pretend it is a play horse and these are the buttons to ride" – one child suggests that the pretend horsy is not a real horse but instead a mechanical horse that needs buttons to start and stop (girl)

"we have to be careful, right? Because some of the blocks are wobbly" – question asked to me as one child begins to climb across the tops of the blocks (girl)

"my car went flying super fast" – child announces as he rolls his toy car down a ramp that was made from the white blocks (boy)

"yea, I'm making a show" – child explains as he rearranges the blocks (boy)
"wait, wait, I have an idea" – child exclaims as she thinks about how to rearrange the white blocks in front of her (girl)

"and I was dreaming about gymnastics, right mom?" – one child talking to another child as she is pretending to be asleep while playing house with the blocks (girl)

"she's the teenager and I'm the baby…
you have to sit here because that is the baby seat" – dialog between two children who are playing pretend family and driving in a car that has been built from the white blocks (girl / girl)

"let's change all of this into a dance class…
pretend we were at a show and you could do anything you wanted to do…
no! you have to do this…" – two children discussing how they are going to pretend play with the white blocks (girl / girl)

Play objects/environments made from blocks:

Beds
Office
Desk
Chair
Stairs
Horse
Motorcycle
Mechanical horse
Boat in water
Stage for show
Gymnastics course
Dance class
Car
House

Toy play brought to white blocks:

-camera brought to blocks during pretend office play as part of the job duties for the boss

-microphone included in pretend office play that was used by the boss to page his worker in another office

-hats and glasses were worn during the pretend office play as disguises so that their neighbors would not recognize them as they left the office space

-toy action figures were brought over to the block area so that they figures could walk and climb on the white blocks

-sewing tape measurer was used as a whip for the pretend horse created from one of the white blocks

-toy cars were rolled up and down the slopes of the white blocks

-wooden blocks were used to create a barrier / gate to the designated block area so that only the two children inside with the white blocks could determine who else could play with them

-kitchen timer used as an alarm clock during pretend family play to wake up sleeping children

-laptop set on top of white blocks while child sat on lower level.

Types of Play:

Physical:

laying down on top of blocks
sitting at pretend desk
climbing up stairs
standing on top of blocks
rocking on pretend horse
whipping pretend horse
pushing pretend buttons on blocks
rolling toy cars
lifting blocks
dancing
twirling like a ballerina
curling up body to snuggle

Pretend:

Working in office as child's dad and dad's boss
Battle between toy action figures
Riding a horse
Riding a motorcycle
Sailing in a boat on water
Performing in a show
Dancing as ballerinas
Driving in a car
Conducting a dance class
Playing sick

Images captured from observation day #1. Photos taken by author, 2008.

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Images captured from observation day #1. Photos taken by author, 2008.

Images captured from observation day #2. Photos taken by author, 2008.

Images captured from observation day #2. Photos taken by author, 2008.

Images captured from observation day #3. Photos taken by author, 2008.






Images captured from observation day #3. Photos taken by author, 2008.

Appendix D

Focus Group Discussion Notes

Focus Group: discussion notes _ 03.14.08
Design Professionals (1 hr)

-question immediately rose from design professional about intended production material

-suggestion to look at Moduform
products dipped in vinyl
PVC coating
look into alternative for PVC due to environmental factors

-Roger Tornar (?)
expert on self-skinning foam process
works for Matrex Furniture Components….Greensboro – northridge street
wife Nancy = furniture designer
would know real-world business workings
what works, what might have problems

-silicon
rotationally molded hollow
ex. Cool oven mitts (target, bed bath & beyond, extra ingrdient)

-keys in material
ability to be colored
no seams
holds up to cleaning solutions

-designers predicted that it would cost around $15 to make the blocks (China) and could sell for around $60

-make pricing matrix based off of current market competitors

-sell them one, two, or make different size kits

-potential product for IKEA

-"Child Kraft" – preschool catalog of products
buy directly for school, daycare, hospitals

-Montessori School / Friends School – Nancy Hoffer (K-5 expert)
Montessori has direct product design line

-packaging for production: easy because they are basic blocks (shrink wrap)

-Marketing strategies

-2 avenues: (1) set up website, brand, identity and sell directly
(2) sell directly to institutions (school, daycare, etc.)

-tell as story: tie it to education

-answer questions about education and safety before they are asked

-look to current market and see the sophistication of products out there and look at their marketing and branding strategies

-pictures/video tapes of product in-use serves as great marketing devices

-tell story about design process…again tie to education…show cohesion… illustrate how product came to lfe

-can it be marketed globally?

Patenting

-design patent easy enough to obtain (but can easily be voided if someone comes and changes a radius or length)

-if there is a direct tie to clinical benefit – possibility of real patent
$5,000 - $10,000

-copyright can be tagged on to design documents (written announcement of ownership)

Name the design!!!!!
Beyond “flippy”

Focus Group: discussion notes _ 03.17.08
Childcare Professionals (45 min)
2 teachers, 1 supervisor

In what ways were concept played out...

-blocks were used in different and varied ways, each time teacher passed by the blocks had taken on a new function.

-blocks were used by themselves but number of functions/experiences were increased as children brought outside toys over to the block area
    -ex. Brought toys over for ramps

-supervisor was intrigued by the length of time that was spent with the blocks
    -rare that children engage in one activity for so long

-in the beginning, some instruction was given to guide what not to do (for safety reasons)…but aside from this, no direction given and children were able to find multiple other uses

Safety

-not acceptable to jump off of the tops of the blocks
    -scale of blocks promoted this activity
    -jumping would be more accepted if there was a soft surface underneath or if the blocks were outside

-the number of children in the block area playing with the blocks was unsafe
    -most childcare facilities would limit number of children
    -play in this area would take shifts to accommodate for everyone

-if blocks were moved out of block area, they could have become unsafe
    -scale of blocks would prove problematic for other play spaces
    -designated block play area was enclosed to accommodate for necessary space and isolate the activity

-safety could become a factor if the blocks were picked up and thrown or stacked
    scale and weight of product proved to somewhat discourage these actions

-foam material is good for safety reasons indoors

-material and forms seemed sturdy enough for play

-teachers were curious about outside use
    -safer for reasons of space

Scale:

-larger scale of blocks promoted more gross motor activity

-smaller scale would have made them more like toys and easier to move in and out of block area

-scale kept children's attention because they were different from toys or furniture

-smaller or larger scale may not have been used together as system

-promotes both calm and active play
  -could be used with children with special needs
  -used in area where you can go away from all other activity
  -used with individual or small group

-in this specific classroom, scale of blocks might have hindered play if placed into other areas because of space restrictions

Context:

-good for larger preschool classrooms or as permanent items

-scale is too big for storage if the blocks are brought in and out of classroom for play

Iconic Associations:

-three main connections
  stair
  ramp
  chair

Marketability:

-could be shared among classrooms

-definitely not sold as individual components because they might be used more as single furniture foms

-buy as sets
  -look for number in sets to be smaller, this way the smaller number could be used in smaller classrooms and sets could be multiplied for larger classrooms or spaces ex. (4) (4+4) (4+4+4)

Further Exploration:

- -testing in different classroom settings
  - -what would children in Montessori school do with blocks?
  - -Erwin Elementary?
  - -Curry Annex is play based setting (more free spirited
    - -how would classrooms of different philosophical values use the blocks?

- -color exploration
  - -teachers interested in how color would add to experience
  - -calming colors (sea green)
  - -not black, not white

- -Outdoor use!
  - -is there material that could be used both indoor and outdoor?
  - -outdoor provides more space for play
  - -important to bring educational experiences outside
  - -plastic material may be better suited for outdoors
  - -large bag for collecting all blocks for storage

Focus Group: discussion notes _ 03.28.08
Child Development Experts (1hr 15 min)
2 professors, 2 doctorate students

After initial intro into my thesis research and project, one member of the focus group asked about weight of blocks…I answered by inviting them to pick the prototype blocks up and manipulate them themselves…this led to about 10 minutes of interaction between the focus group and the play system.

- -stacked four high like totem pole
- -checked for stability of blocks
- -created cave for them to get underneath
- -put "chairs" together for "couch"
- -searched to solve the "puzzle"
- -rotated blocks in hopes of finding a place for them to fit together
- -wanted to rock on one block but no flat surface to sit on
- -placed blocks underneath other blocks to add stability

context

- -storage concerns were quickly brought up
  - -not enough space in typical preschool classrooms to store the blocks
  - -members of focus groups wanted to see the blocks fit back together into a larger block to provide easier storage

- -indoor space for play might be limited in terms of typical preschool classrooms
  - -think about use outdoors!
    - -outdoor space would be larger for play
    - -might encourage more active and gross motor activities
    - -product would be more appealing if you could use both indoor and outdoor…preschools don't always have enough money to buy quality outdoor equipment

safety

- -stability was concern among several members of the group
  - -some wobbling ok for build of balancing skills
  - -two blocks called out in particular
    - -members did not feel as though these 2 blocks could be stable enough as individual components…especially if children chose to jump off the tops of them
  - -children could stack blocks but teachers would have to make a rule that children would not be allowed to climb or jump off of stacked blocks

- -weight and size are appropriate for preschool children
  - -not too awkward
  - -cut-outs work well for grasping

-simple cubes would prove to be difficult to manipulate at this size without providing indentions and contour variations on sides

-cleanability, non-toxic
-materials must be able to be wiped down easily and be safe providing that a child bits into the surface

selling potential
-building mathematical skills
-if blocks fit together into understood geometry, this would be good for math learning…..caters to growing interest in linking play activities to math.

-some preschools would not be sold on the product if it was only advertised to promote creative development….needs to go further for learning skills

form
-shapes do not dictate function

-so many variations as to how these blocks could be used
-different shapes work to increase functionality

-no form seemed too abstract…and no forms called out any one function

scale
-this scale presents the largest possible size for block building
-works well in combining additional building materials…varied sizes of block play occurring at once

-scale promotes gross motor activity…climbing, balancing, etc.

child development
-cognitive
-what goes together?, what fits together
-works on problem solving skills
-mathematical learning
-"pre-physics" – testing out gravity and seeing toy cars go faster down ramps that have greater slopes

-gross motor
-balance, agility

-creativity
-different configurations relating to pretend play
-finding ways to use other materials in conjunction with the system blocks

-social
-very different effect of placing this system within a preschool classroom versus that of an individual home
-encourages children to work together in moving the blocks and arranging them in a manner that will suit their play needs

-further explorations
-use pieces that were cut away from the forms
-void pieces become a part of the system
used to improve stability for some blocks
could use Velcro to attach smaller pieces to larger blocks

-colors
used as cues as to how 2 pieces can come together
case made for neutral across the board to leave interpretation up to child